APR 22 1911

THE HEATING AND VENTILATING MAGAZINE

Vol. VIII, No. 4.
$1.00 a year, 10 cents a copy.

NEW YORK, APRIL, 1911

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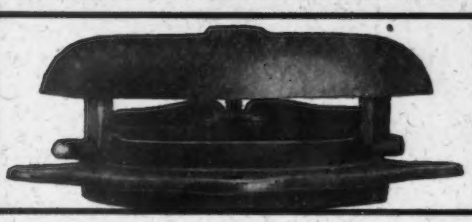

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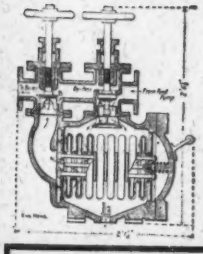

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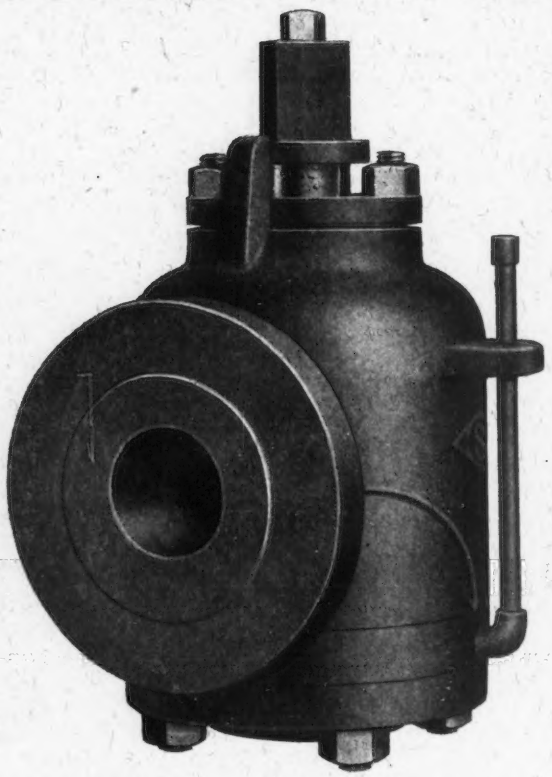

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK APRIL, 1911

Air in the New York Subway

BY DR. GEORGE A. SOPER

EDITOR'S NOTE.—*The accompanying paper is a resumé of an elaborate series of experiments conducted by Dr. Soper for the Board of Rapid Transit Railroad Commissioners in New York. The detailed report of these tests, together with many other researches on the general subject of air conditions in subways, both in this country and Europe, is contained in Dr. Soper's book, "Air and Ventilation in Subways," recently issued.*

When the New York subway was first opened there was a good deal of complaint as to the condition of the air. The subway grew hot and there were unpleasant odors. Some more or less scientific people made a few quick-and-easy determinations of the oxygen and the carbon dioxide in the air, and published alarming reports in the newspapers. Professor Chandler, of Columbia University, made some careful examinations of the carbon dioxide, which were reassuring enough for him and many others, but the Rapid Transit Commissioners were not fully satisfied. They held the view that here was a great experiment. The subway was certainly uncomfortable. Something was the matter with the ventilation. Was the air dangerous to breathe? If the air was bad and could not be made wholesome, there would be no more subways built. The importance of this question was considered great enough to warrant thorough investigation. I was asked to make the investigation and did so.

The temperature and humidity were determined. There were 50,000 determinations of the temperature and humidity. The oxygen was estimated; there were 80 determinations of oxygen. The carbon dioxide was determined; there were 3,000 analyses of that. The numbers of bacteria were determined; there were about 2,500 bacteriological examinations. The dust was analyzed. I found the problem to be largely one of dust, so far as health was directly and seriously concerned.

I found at the outset that the ordinary quick-and-easy methods of analysis employed in most ventilation work were not suitable for this case. And so the most accurate determinations which it was practicable to make on a large scale and under the difficult conditions of subway traffic were employed.

It was only by the most refined methods that we could detect any difference between the oxygen in the subway and that in the outside air. The difference averaged only about 1½ parts of carbon dioxide per 10,000 parts of air. It was almost incredible that such a slight difference should exist while the air in the subway was so unpleasant, yet the fact could not be disputed.

It was difficult to get samples. It was desirable that they should be

collected, as far as possible, away from people. So I had the sample bottles put in a basket with a pump and a thermometer. The investigator appeared to be a young man proceeding to market. He would go to the part of the subway previously determined on, await his opportunity and then take the cover off the basket sufficiently to insert a rubber tube. Then with the air pump he would pump air through a flask until the flask was filled with the air to be analyzed. I found we could get a reliable sample in that way, and in that way alone.

Fig. 1 shows some of the results. There were about 2,000 analyses averaged to get the figures from which these curves were made. The amount of carbon dioxide in the air of the subway is shown by the heavier upper line; that in the streets by the lighter line below. Note the correspondence between the rising and the falling of these two lines.

VARIATION OF CO_2 IN STREET AIR

The observations extended over several months. I found there was a difference in the amount of carbon dioxide in the air of the streets at different hours of the day. Rush hours in the subway always gave larger amounts of carbon dioxide than other hours. And, curiously enough, the rush hours in the subway appeared to be the rush hours in the streets. Apparently, the air in the streets was affected by the great number of people in them. The striking rise shown in December is due to the large increase in the number of people using the subway and streets. It was the Christmas season.

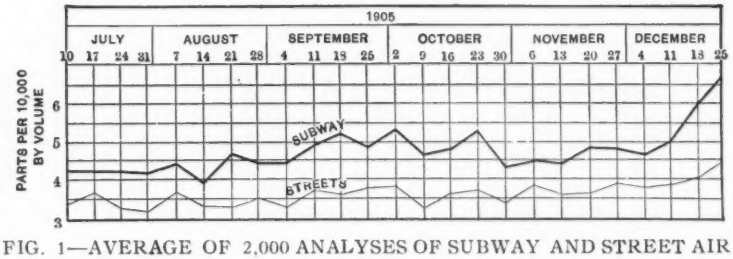


FIG. 1—AVERAGE OF 2,000 ANALYSES OF SUBWAY AND STREET AIR

There were regular variations in the chemical condition of the air at different hours of the day and night. At 6 a. m. the carbon dioxide in the subway was at a minimum. It then increased rapidly up to the end of the morning rush hour. From the end of the morning rush hours there was a gradual reduction until just before noon, when the reduction ceased and there was a slight increase. The increase was apparently due to the fact that there was a slight rush of people who used the subway about noon in the shopping district. After noon there was a progressive reduction down to the beginning of the rush hours of the afternoon, when there was a decided increase. From that time there was a pretty constant reduction until morning.

There was much more carbon dioxide at 6 p. m. than during the rush hours of the morning, because more people traveled at that time. The crowding was much greater because the rush period was shorter. Most of the people who went to business between seven and nine wanted to get home as soon after six as possible.

Fig. 2 shows a compound diagram which may need a word of explanation. We have here the amount of carbon dioxide found at the different stations. The subway is 20 miles long, and the most interesting part of it, from the standpoint of ventilation, is between Brooklyn Bridge and Seventy-ninth Street. This diagram represents the condition between those two points. The amount of carbon dioxide in the air at different stations for the period from July 14 to September 1 lies along the lower broken line. Later in the season, when more people were traveling, there was much more carbon dioxide at those stations. We have this fact shown on another broken line. Later, in November, when the heat began to

abate and more active business conditions led more people to take the subway, there was a further increase in the amount of carbon dioxide, and so on until the end of December. There is one diagram for the afternoon hours and one for the morning hours. For each station you will find on this diagram the amount of carbon dioxide for the months covered in the investigation.

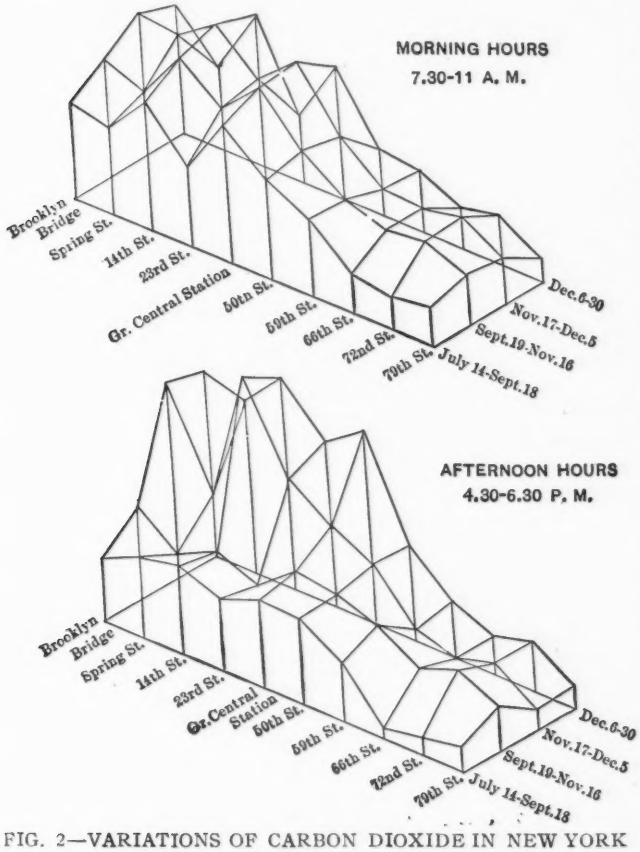


FIG. 2—VARIATIONS OF CARBON DIOXIDE IN NEW YORK SUBWAY, AS SHOWN BY FOUR TESTS

VENTILATION OF SUBWAY DEPENDS ON NUMBER OF OPENINGS

One of the most useful results of the whole work is illustrated in Fig. 3. The point illustrated is that a distinct relation existed between the number of openings to the street and the condition of the air. This led me to the opinion, which I have since been able thoroughly to confirm, that the New York subway and other subways of its kind will ventilate themselves if they are given a chance. The New York subway did not have a chance, and the Paris subway did not, for the reason that it was too tightly enclosed for the air to move in and out with the requisite freedom.

It is not necessary to put fans into subways like the New York subway. In fact, it is doubtful if fans, even on the largest scale practicable, will produce material improvement, except immediately at the points where, for example, outside air is pumped in. Fans will not improve the air sensibly for any considerable distance. This was proved by my investigations. But if you will give the subway openings enough, it will breathe of itself. The breathing bears a rather close analogy to that of animals.

The subway in New York has been materially improved by providing blow-holes through which the air set in motion by the trains can move in and out. I have said the need of so much opening was not evident at first.

METHOD OF MAKING BACTERIOLOGICAL EXAMINATIONS

Bacteriological examinations of the air were made. Professor Sedgwick devised filters for air some years ago, and it was partly upon his plan that our filters were devised. They are small tubes filled with sand and plugged with cotton at both ends. We fastened two filters in tandem on a rubber tube, which was connected with a well made and carefully operated pump. The number of strokes of the pump gave us the quantity of air passed through the filters. In passing through the filters the air parted with its germs. After filtration the filters were taken to the laboratory and there dealt with in a way commonly employed in bacterial analysis.

As was said, the fans did not materially improve the general air in the subway; the blow-holes did. Before the fans were put in it is probable that the air was renewed once every half hour. The amount of renewal after large sections of the roof were opened was very great. It wasn't possible to tell exactly how often the air was renewed, for the reason that the number of people traveling in the subway was not known by the city. There was no census of travel for a long time after the subway was put in operation and none until after my investigations had been completed.

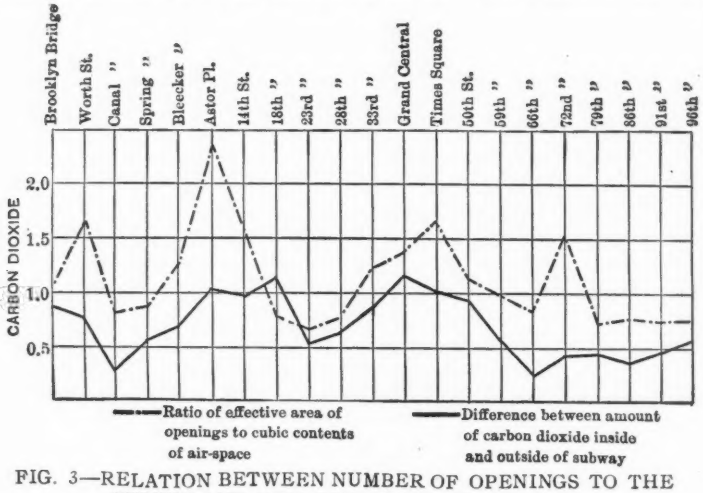


FIG. 3—RELATION BETWEEN NUMBER OF OPENINGS TO THE STREET AND THE CONDITION OF THE AIR

In Fig. 4 you see the results of determinations of the number of bacteria at the different stations throughout the length of the subway and in the streets overhead. There is a general correspondence between these two sets of figures. The average of all the analyses shows that about half as many bacteria were found in the air of the subway as in the air of the streets. The numbers of bacteria varied with a good many circumstances, one of them being the amount of air moving in the subway.

The accompanying table shows the effect of improper methods of cleaning. The porters swept the platforms without first moistening them, and this greatly increased the numbers of bacteria in the air. The movement of the trains kept the bacteria in the air because the movement of trains set the air in motion, and the dust particles were kept afloat also by the air currents.

DIFFICULTY OF DETERMINING DUST IN AIR

It was very difficult to devise a plan for determining the quantity of dust in the air. The difficulty lay in the necessity of examining a large volume of air. The amount of dust was small to separate and weigh with accuracy, so that a special apparatus was employed. It consisted partly of an ordinary Root blower, adjusted so that it drew air

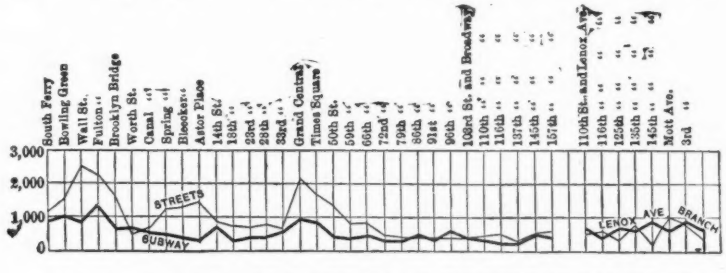
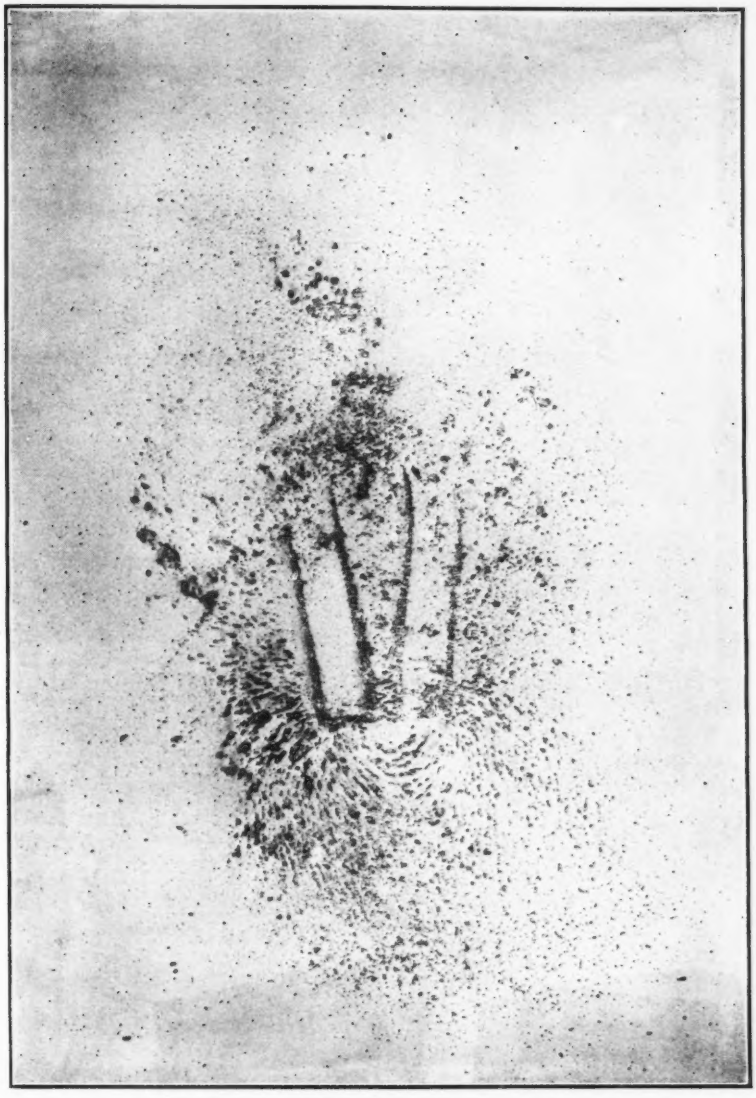


FIG. 4—NUMBER OF BACTERIA AT DIFFERENT POINTS OF SUBWAY AND IN STREETS OVERHEAD

through a gas-meter. The meter was carefully tested and found to work with sufficient accuracy in this manner. A filter was attached to the gas meter, so that when this pump was operated, the air passed down through the filter to the meter. The filter was composed of sugar. After a sufficient number of cubic feet of air had been passed through the filter, the filter was disconnected and taken to the laboratory. There the sugar was dissolved in water. The water was then filtered and the solid particles were dried and weighed.



MAGNETIC FIELD FORMED BY SUBWAY DUST
A Piece of Paper was laid on top of a Horse Shoe Magnet and Subway Dust was Sprinkled on the Paper

EFFECT ON THE NUMBERS OF BACTERIA IN THE AIR OF THE SUBWAY PRODUCED BY SWEEPING THE PLATFORMS IMPROPERLY

Place	Time, A.M.	Microorganisms per Cubic Meter of Air		Ratio of Bacteria to Molds
		Bacteria	Molds	
Fulton Street Station, South End, west platform. Remote from openings to streets	10.25	4,900	100	49 : 1
Porter began sweeping near by	10.41	13,200	50	264 : 1
Still sweeping, but farther off	10.57	8,100	0	.....
Still sweeping, middle of platform	11.12	8,500	0	.....
Average	.....	8,600	38	226 : 1

Heating and Ventilation of Union League Club, Philadelphia

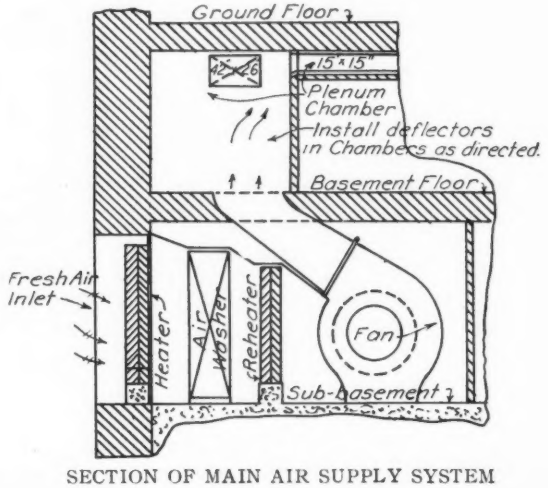
The Union League Club in Philadelphia has recently found it advisable to provide larger quarters for its members and to this end has built a six-story addition to the original club house. In design and appointments the new building follows most modern practice and particular attention has been paid to insuring absolute comfort for the occupants.

The question of heating and ventilation received an unusual amount of attention. Two separate systems of indirect heating are employed, as well as a vacuum steam system for use with direct radiators. For extracting the vitiated air from the building three distinct exhaust systems have been designed. The main air supply is obtained from a vertical duct, leading from a sidewalk grating down to the sub-basement, where a right angle turn brings the fresh air to a tempering coil and air washer of the Webster type. The former contains 1,650 sq. ft. of heating surface and beyond the air washer is a reheater of the same capacity. The air washer is designed to cleanse 45,000 cu. ft. of air per minute. The spray water is circulated by means of a 2½ in. Worthington centrifugal pump direct driven by a 7½ H. P. motor.

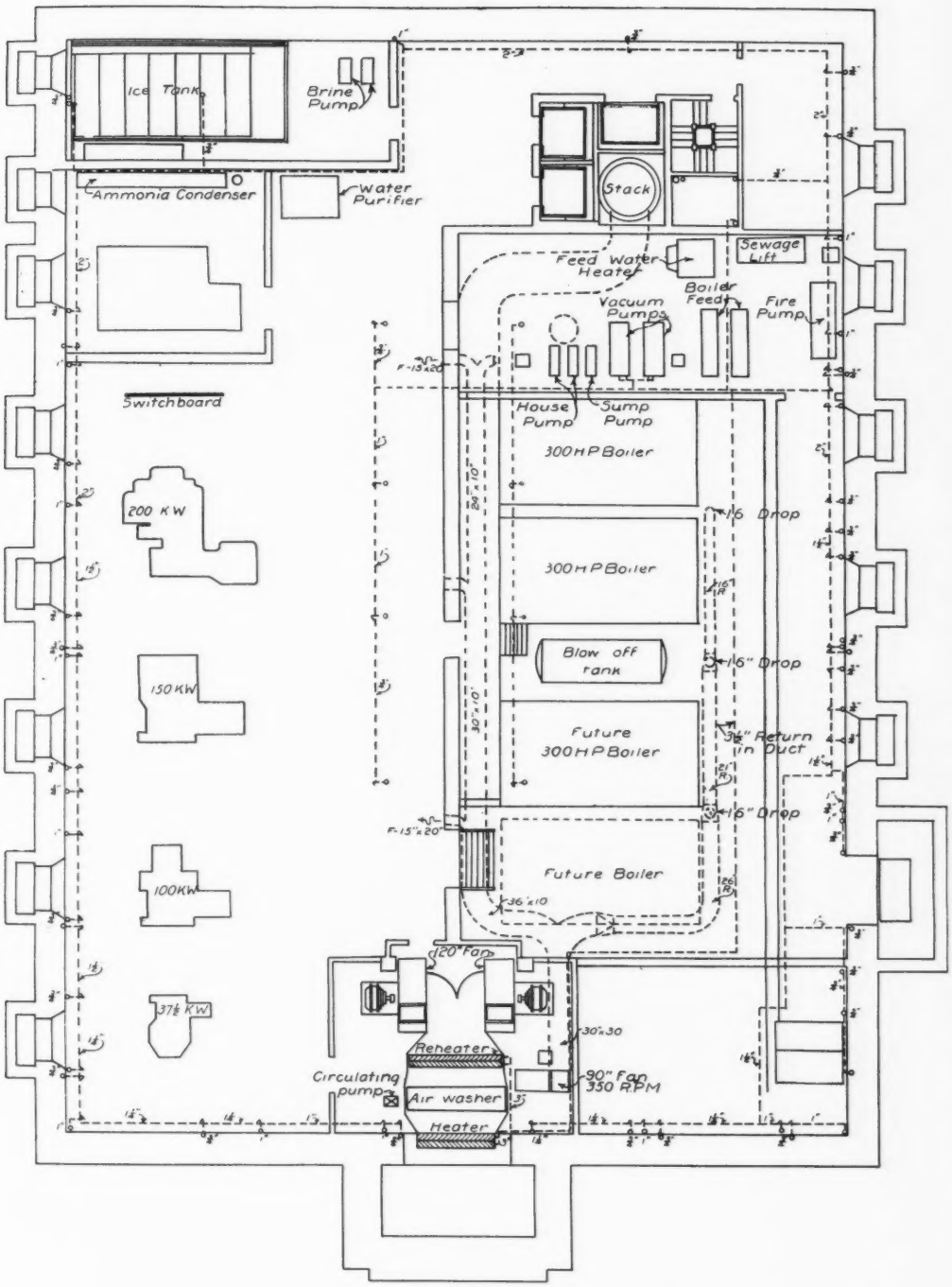
Beyond the reheater the air duct divides into two branches, each branch leading to a motor driven fan which discharges the air upward through a short vertical shaft to three main horizontal ducts under the ground floor ceiling. Of these the largest, which is 15 ft. by 15 in. in cross section, runs under the ground floor corridor, with branches leading off from either side to supply warm air to this story of the building. At the rear end of the corridor the duct divides into two branches leading to the sides of the building where risers lead off to supply the first and second floors. Indirect heating units are installed in these branches under the ground floor as secondary heaters for the first and second floors. At the front end of the building two similar branch ducts lead from the vertical warm air shaft and supply the remaining area of the first and second floors by flat vertical air ducts in the same manner.

For the ventilation of the engine and boiler rooms a separate fan is provided. This fan, which is located in the sub-basement beside the air washer, supplies untempered air for the operating force through two main horizontal ducts on the sub-basement ceiling.

The air supply for the third and fourth floors is furnished by a blower in the loft which discharges fresh air through an indirect heater to ducts supplying both floors. The source of supply being at a considerable height above the ground it was not considered necessary to install an air washer for this system, its place being taken by a cloth filter over the inlet pipe.



SECTION OF MAIN AIR SUPPLY SYSTEM



PLAN OF SUB-BASEMENT, UNION LEAGUE CLUB, PHILADELPHIA, SHOWING MAIN AIR SUPPLY SYSTEM, ALSO SYSTEM FOR VENTILATING ENGINE AND BOILER ROOMS

There are three separate exhaust systems, one for the ground floor, a second for the first and second floors, and another for the third and fourth floors. No positive ventilation is provided on the top floor, which is used for sleeping rooms.

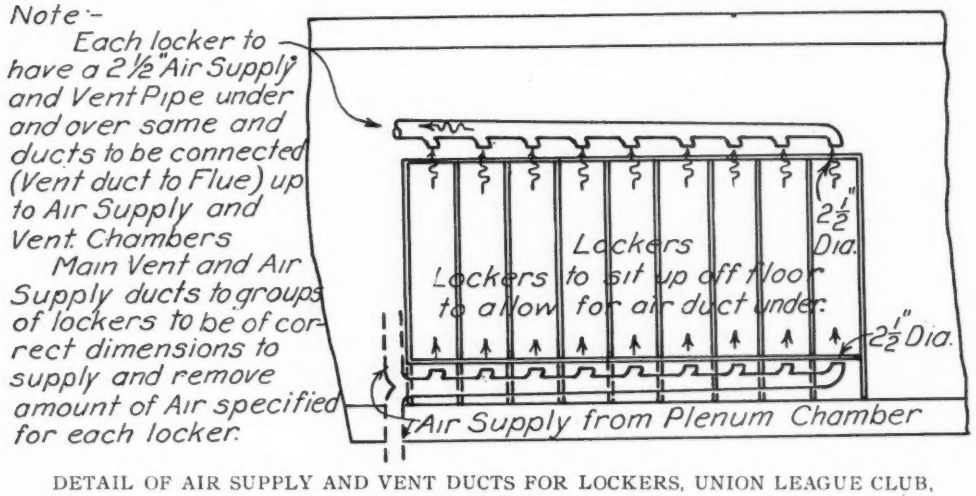
The ground floor system is particularly complete. On this floor are located the bowling alleys, barber shop, lockers, etc. Individual inlet and discharge ducts are provided for each separate locker, thus insuring rapid drying of clothes and the entire absence of the odors so often associated with locker rooms. All the exhaust ducts on this floor are vented through a main duct running along the corridor ceiling and discharging to the roof through a vertical air shaft. To insure positive movement of the air a 60-in. disc fan is located on the roof.

The system of exhaust ventilation for the first and second floors is similar in its general features to that for the ground floor except that it is not quite so complete as these two floors are for general club room and do not require as much care in ventilating as does the ground floor. The first floor is ventilated by means of vertical ducts which discharge into parallel horizontal ducts on the ceiling of the second floor. The latter also serve the second floor and convey the air to a vertical shaft similar to that supplying the ground floor and surmounted at the roof with a 72-in. disc fan.

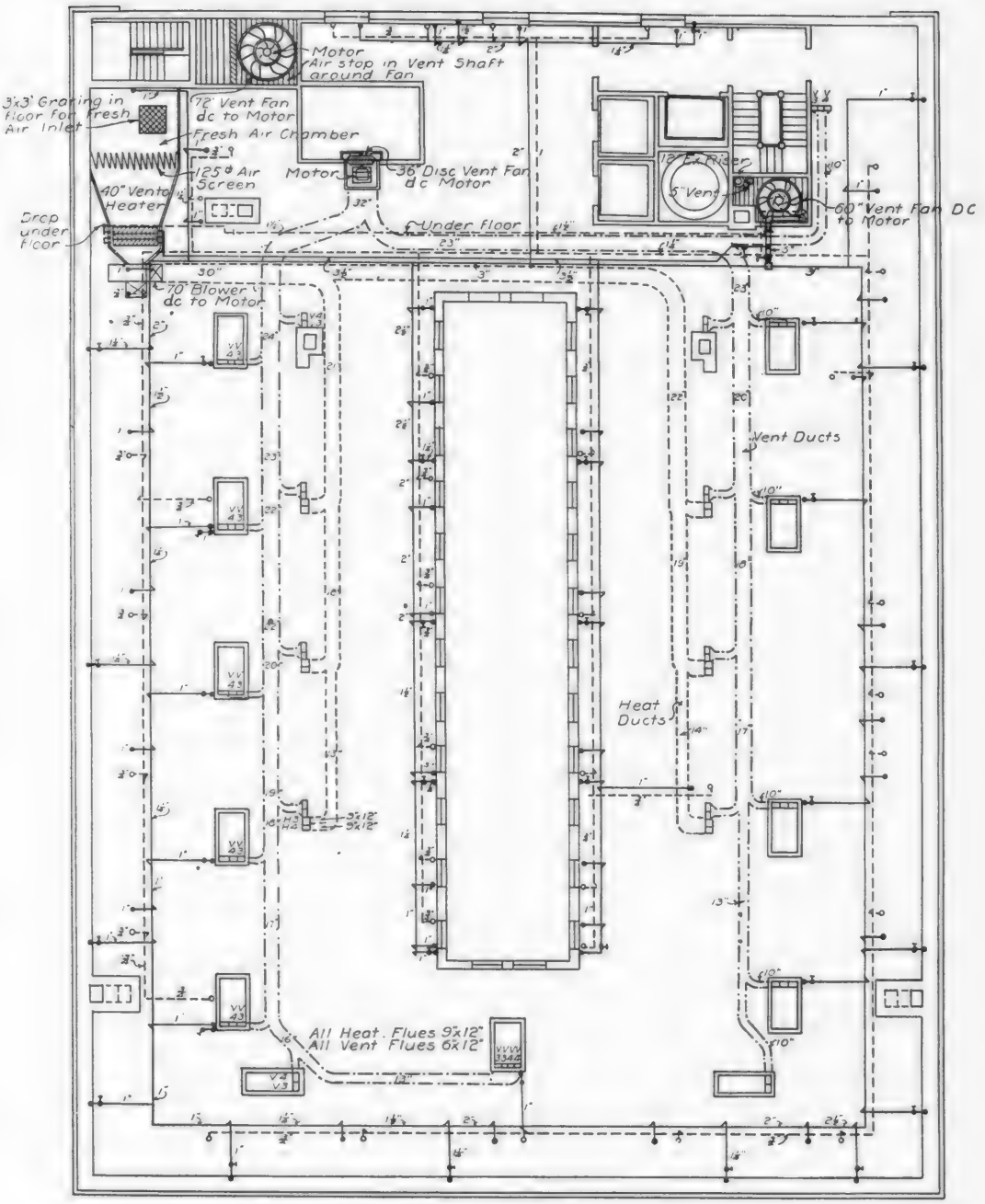
The exhaust system for the third and fourth floors is practically identical with that for the two floors below except that the main horizontal exhaust ducts are run in the loft and discharge into the space above the main stair skylight where is located a 36-in. disc fan.

So numerous are the inlet and outlet openings for the various fan systems that plenty of air can be circulated without the necessity of high velocities and hence with a minimum of danger from drafts. As the fans and the air washer pump are all motor driven, starting and stopping them is an exceedingly simple matter and no other attendance except occasional oiling is required. The temperature regulation of this building is entirely under thermostatic control, both the indirect heating systems already described and the direct units being automatically regulated at all times.

All direct radiators are operated on the Webster vacuum system. The main 12-in. exhaust line from the engines, supplemented by a 10-in. line from the pumps, runs to the feed water heater where an 8-in. branch pipe is taken off to the heating system. This connects with an 8-in. main supply riser running to the


Note:-
Each locker to have a 2½" Air Supply and Vent Pipe under and over same and ducts to be connected (Vent duct to Flue) up to Air Supply and Vent. Chambers
Main Vent and Air Supply ducts to groups of lockers to be of correct dimensions to supply and remove amount of Air specified for each locker.
Lockers to sit up off floor to allow for air duct under.
2½" Dia.
2½" Dia.
Air Supply from Plenum Chamber

DETAIL OF AIR SUPPLY AND VENT DUCTS FOR LOCKERS, UNION LEAGUE CLUB, PHILADELPHIA



LOFT PLAN, UNION LEAGUE CLUB, PHILADELPHIA, SHOWING AIR SUPPLY SYSTEM FOR THIRD AND FOURTH FLOORS AND EXHAUST SYSTEMS

loft. A branch header connects with this riser just below the ground floor level to supply the direct units in the basement, the ground floor and the first and second floor, the three latter stories being served by up-feed risers and the basement by down-feed risers. Down-feed supply lines are dripped to the returns through water seal motors.

A ring header in the loft serves the direct radiators on the third, fourth and fifth floors, the latter by up-feed risers and the third and fourth floors by means of down-feed supply pipes. The returns from the fifth floor are piped to a ring header in the loft and thence by way of a vertical riser to the basement return main, while the lower floor returns flow through separate risers to the main return header in the sub-basement. This main terminates at the two 8-in. x 12-in. x 12-in. vacuum pumps, to either or both of which it may be connected. The discharge from these pipes passes to an air separating tank on the sub-basement ceiling and thence to the feed water heater. Separate supply and return lines serve the indirect heaters, the returns connecting with the main return header.

Steam for all purposes is supplied by three 300 H. P. Edgemoor water tube boilers through two main steam headers. One of these supplies the generator engines, with a branch to the refrigerating plant, and the other furnishes steam for all the other pumps. By means of cross connections it is possible to supply live steam through reducing valves, if necessary, to the heating system.

The operation of the heating and ventilating system of this building has justified the elaborate layout. Flexibility is one of its most noticeable points and the detailed thoroughness of the architect's plan as carried out by the engineers, Francis Brothers & Jellett, Inc., has resulted in a most satisfactory sytem.

Horace Trumbauer is the architect of the building. The contractors for the work were Charles Monday & Co.

A Novel Drying System

A novel drying system, which operates successfully, was recently designed by F. W. Dean, mill engineer and architect, of Boston, for the drying of fibre board. The fundamental purpose was to give such flexibility to the system that different chambers, different temperatures of air and different degrees of humidity might be utilized.

The complete system is divided into six individual groups of apparatus, two of which may be classed as single groups and four as double groups. Each group comprises a series of steam coils, supported by angle iron frames suspended from the roof beams of the drying room. The double groups comprise 2,520 lin. ft. of 1¼ in. pipe; one of the single groups contains 1,296 ft. and the other 1,440 ft. of the same size pipe. The pipes are made into return bends 6 in. on centres. Each individual group consists of 5 unit coils. Each cell in turn contains 12 pipes, 8 ft. long in the case of the single groups, and 14 ft. long in the case of the double groups. There are three coils in each section and fifteen coils in each chamber.

The single groups are supplied with exhaust steam through 4 in. pipes and the double groups through 6 in. pipe. Valves are provided in all branches to the individual unit coils so that any one can be cut off to reduce the temperature or for repairs, if such should prove necessary. The drips are trapped and discharged into a main which leads to the receiver pump.

All of the groups are enclosed in 2 ft. x 9 ft. flues made up of angles and asbestos covered metal, located near the ceiling of the room so that the space beneath is left entirely clear for the hanging of the fibre board, across which the air is forced. Motor driven fans supported in a monitor force the air through the coil chambers where it is heated to the desired degree. Each fan has a 54 in. wheel running at 300 R. P. M., chain driven by an individual 5 H. P. motor. There are two fans for each double unit and one fan for each single one.

The exhaust flues from the drying rooms have an arrangement of dampers whereby the same air or any proportion of it can be used over and over until saturated. By the proper regulation of the air supply, a great saving of heat can be effected.

Some of the Factors that Affect the Cost of Generating and Distributing Steam for Heating, a paper by Charles R. Bishop, read at the last annual convention of the National District Heating Engineers in Toledo, has been reprinted by the American District Steam Co., North Tonawanda, N. Y., as Bulletin No. 120. We understand that copies may be had for the asking by addressing the company.

How Wind Affects the Heating of Buildings

(Concluded from March Issue)

Extract from Report of Tests of Gymnasium Buildings at Michigan University by J. E. Emswiler, mechanical instructor, under supervision of M. E. Cooley, dean of the engineering school:

Men's gymnasium. Exposed on west, south and east. Usual number of windows and doors. Large and very leaky skylight. Three doors leading to basement. Heated and ventilated by fan system. Inlet ducts in north wall above running track (approximately second story); vent ducts in north wall at basement floor. Area fresh air openings, 32.31 sq. ft. Area vent openings, 33.45 sq. ft. Floor registers in main floor at east and west walls.

A series of tests were made in the spring of 1909 to determine leakages around doors and windows and the effect of leakage on vent flow. Most of the windows showed leakage at bottom or sides of sashes and between sashes. This was ascertained

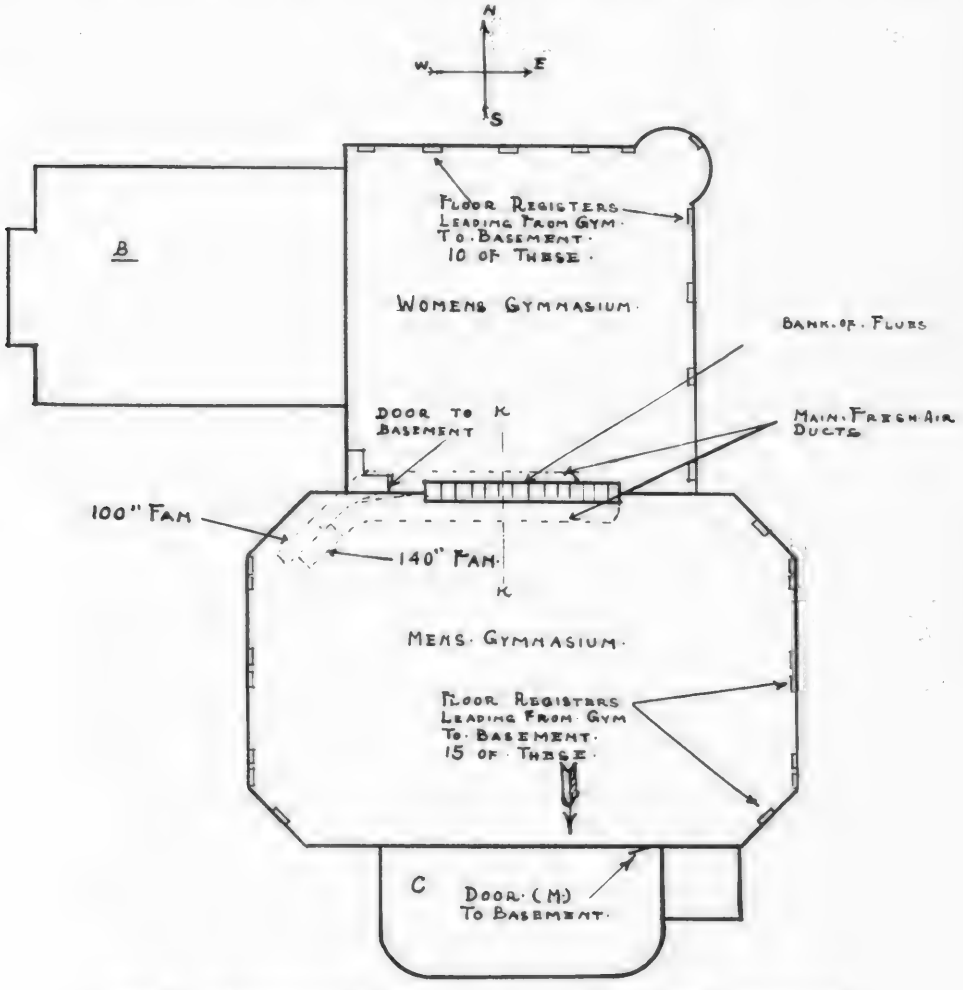


FIG. 1—ARRANGEMENT OF HEATING SYSTEM IN MEN'S GYMNASIUM, UNIVERSITY OF MICHIGAN

by means of a special funnel, having one end in the form of a long narrow opening, designed to fit over a crack at bottom or side of a door or window sash.

From this end the shape gradually

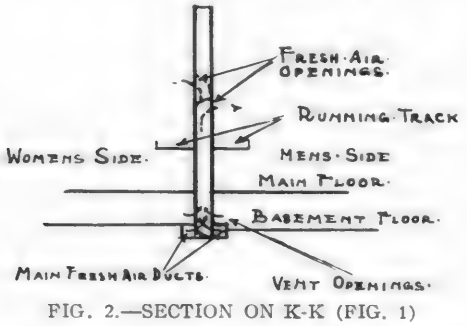


FIG. 2.—SECTION ON K-K (FIG. 1)

changed, until, at the other end it became circular, and of the size of the wheel guard of an anemometer. When the funnel was placed over a crack with the anemometer in place, if there was an appreciable leak through the crack it was indicated by the movement of the anemometer wheel. While this did not provide a quantitative measurement of the leakage, it did afford an excellent means of comparing the leakage at different places.

The velocities read ran as high as 100 ft. per minute to 18-in. length of crack, and in an especially bad case as high as 350 ft. per minute. Leakage tests were again made in the spring of 1910 after the windows had been equipped with a metal weather strip. No leakage could be detected except in one case due to a bad sash. Leakage at cracks of doors showed a reading of about 300 ft. per minute.

In the tests of 1909 the fan supply was 25,350 cu. ft. per minute, and the average vent volume was 7,100 cu. ft. per minute, or 28% of the supply. All windows and doors were closed during tests.

In the summer of 1909 all windows were equipped with an expansion joint metal weather strip. In the spring of 1910 a series of tests similar to those of 1909 was made.

During these tests the fan supply was 22,000 cu. ft. per minute, and the average vent volume was 11,190 cu. ft. per minute, or 49.5% of the supply.

The foregoing shows primarily the effect of leakage as the wind conditions in 1909 did not differ greatly during the different tests. In one test in 1909, with stiff breeze from the southeast, the vent flow was 7% less than with a slight breeze from the northeast.

TEST OF WOMEN'S GYMNASIUM

Women's gymnasium. Exposed on north and east sides. Large and leaky skylight. One door leading to basement. Fan system. Inlet ducts in south wall, same height as in men's gymnasium. Floor registers in main floor north and east sides. Vent ducts in south wall of basement. Area fresh air openings, 20.46 sq. ft. Area vent ducts, 18.13 sq. ft. Fan supply, 1909, 10,750 cu. ft. per minute. Amount at vent with stiff southeast wind, 1,780 cu. ft. per minute. Amount of vent with slight northeast wind, 4,000 cu. ft. per minute. All windows weather stripped in 1909. Fan supply, 1910, 9,530 cu. ft. per minute. Amount at vent, 4,170 cu. ft. per minute. Negligible variation on account of wind noted after weather stripping.

The foregoing shows the effect of leakage and wind both to some extent.

In all the tests it is assumed that

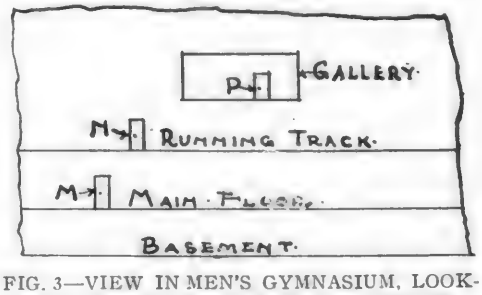


FIG. 3—VIEW IN MEN'S GYMNASIUM, LOOKING SOUTH (IN DIRECTION OF ARROW, FIG. 1) SHOWING DOORS ON SOUTH SIDE OF BUILDING

the leakage from doors and skylights was fairly constant, as no attempt standardize this leakage was made. It is the opinion of your committee that a study of the foregoing examples will demonstrate the fact that leakage and wind velocities cause a great range of effect on interior conditions of heat and ventilation much greater than commonly supposed.

We deplore the fact that the lack of time has prevented a greater accumulation of data, and trust that future committees may be enabled to gather more information along this line. If we can approach the standard used in Germany, much controversy between engineers and heating contractors on the one side and owners and architects on the other will be avoided. It is manifestly unfair for an architect to make plans and specifications for a building and require a heating contractor to heat the "plans" to 70° F., or anything else, in zero or other weather. The variation in amount of free opening about doors and windows is very great.

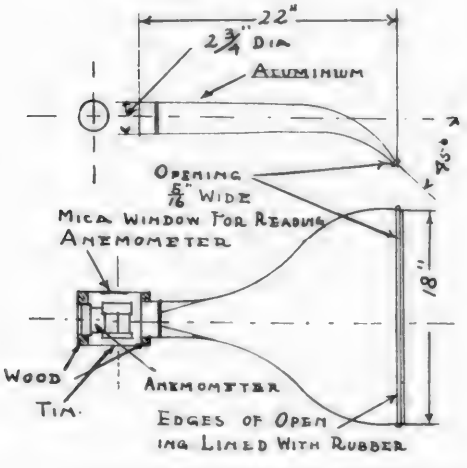


FIG. 4—SPECIAL NOZZLE FOR MEASURING LEAKAGE

It will be recalled that C. B. Thompson, after spending some time in research work in Germany, said at the semi-annual meeting of this society at Niagara Falls in July, 1908: "What is known as the German co-efficient of heat losses is used and accepted as a standard all over the continent of Europe. The German co-efficient for glass had nothing whatever to do with the way the sash is fitted to the frame, and, when you come to think of it, it would be impossible to give a co-efficient for the glass and the leakage about the sash, because one might be tightly fitted and another ¼ in. away from the frame as you describe. If this society can get together sufficient data to establish a set of standards for the guidance of heating engineers, architects and owners, it will have accomplished a great work. With an accepted set of standards a heating engineer who installed work in accordance with such standards would collect his pay and not wait, as he now has to, until cold weather to test the apparatus before he can get a final settlement. In Germany all that is asked of a heating engineer is to install the heating apparatus in accordance with Rietschel's formulæ. Then, if the heating apparatus does not heat, the builder is called upto to make good."

Capt. Andrus B. Reck, of Copenhagen, told one of our members recently that the plan of procedure in Germany was substantially as follows:

The government has a set of standards for different classes of construction. Building plans are submitted to an engineer or contractor, who lays out his heating plant in accordance with these standards. The layout is inspected, and, if correct, is O.K.'d by a government inspector. After the plant is installed it s tested by a government inspector and, if properly installed, the contractor's bill is O.K.'d by the inspector. The contractor does not have to wait a heating season for his money. If the building does not heat satisfactorily in cold weather, the inspector is again called in, and his verdict is almost invariably "Fix up your windows."

Your committee is confident that members of this society, particularly those interested in central heating plants, have large quantities of data bearing directly on this subject. Such data would enable a committee to tabulate and report information which could be used in formulating a standard.

The committee which reported the investigations was composed of D. M. Quay, chairman; H. W. Whitten and George Huey.

Air Supply in Submarine Work

As a further contribution to the discussion of the effects of vitiated air on the human system, some interesting facts have been obtained by government experimenters from manufacturers of diving apparatus and submarine appliances and from the users of such apparatus.

It is a common custom for divers to measure the amount of air furnished them by the pressure of certain gauges connected with the pumps. The release valve in the diving helmet is adjusted by the diver himself so as to allow the air to escape as fast as desired. The man at the surface working the pump is supposed to keep the pressure constant. While much of the information regarding the ventilation of diving helmets is based on empirical rather than strict scientific grounds, certain estimations can be made which are probably approximately correct.

The manufacturer of one diving apparatus stated that for a diver working at 50 ft. under water, sufficient air would be furnished by a 3-cylinder, single-action pump with cylinder of 3.5 in. diameter and a stroke of 6 in. working at about twenty strokes per minute. The volume of air thus delivered, assuming the diver to be at atmospheric pressure, is computed to be 57.1 liters. (Approx. 2 cu. ft.)

Another manufacturer states that a single-cylinder, double-acting pump with a 4-in. cylinder and a 6-in. stroke will supply most men at 50 ft. of water. Some men have used it for 60 ft., while others say it is not enough for 40 ft., the same speed being used in all cases. This difference in the amount of air required by different individuals is quite commonly noted by divers. A fair estimation of the average efficiency is said by the second manufacturer to be the amount of air discharged by a 3-cylinder, single-action pump, with pistons 3.25 in. in diameter and a 6-in. stroke. This pump, when supplying a diver at almost any depth, is operated at about thirty turns per minute, thus giving 73.6 liters per minute. (Approx. 2½ cu. ft.) It is stated that the English divers use for excessively deep work, say 150 ft., a 3-cylinder, single-action pump, each cylinder 4 in. inside diameter and 6-in. stroke, with about the same number of turns per minute, i. e., 30, which would give a current of 111 liters per minute (nearly 4 cu. ft.) Although there are wide variations in the volume of air delivered by these different forms of pump, it is probably fair to assume that divers in general obtain about 65 to 70 liters per minute, or somewhat less than the rate of ventilation in the respiration calorimeter referred to in recent issues of THE HEATING AND VENTILATING MAGAZINE. It is stated that divers working in 10 to 20 ft. of water could probably work under these conditions for twenty-four hours without coming up, although their sojourn is customarily not longer than five or six hours. The return to the surface, however, when working in shallow water is determined not by any discomfort due to poor ventilation, but simply by the desire for food.

Many remarkable statements have been made regarding the ventilation of the submarine boats, which have made such marked advances in the past decade. L. Y. Spear, of Quincy, Mass., gives the following information regarding the ventilation of the submarine torpedo boat built by the company of which he is vice-president.

VENTILATION OF SUBMARINE TORPEDO BOATS

In one test one of the boats was submerged for a period of fifteen hours with a crew of six men. The free-air capacity in the interior at about atmospheric pressure was approximately 2,250 cu. ft. No fresh air was supplied nor was any foul

air removed, nor any chemical means of purification used. At the expiration of the test the interior of the boat was somewhat "close," like a "stuffy" room, but there were absolutely no observable bad effects upon the members of the crew. The amount of air supplied each man per minute, according to computations based upon these figures, was about 12 liters (0.42 cu. ft.)

On another occasion, during an official trial at Newport, in June, 1904, the boat was submerged for over twelve hours with nine men on board. No change whatever was made in the air until the expiration of 11½ hours, when the air was renewed by pumping out the foul air and admitting fresh air from compressed stores. This was done merely to demonstrate to the trial board that the apparatus on board for the purpose was satisfactory, and not because there was any discomfort due to the condition of the air. Neither of these tests was carried to its ultimate conclusion, so that we do not know at present just how long a crew could remain without any change in the air supply. Compressed air at 2,500 lbs. per square inch, however, is required for other purposes in the boats, and a sufficient excess of this is carried to change the air in the boat several times.

Obviously, in the case of a submarine boat as well as with the divers, the question of temperature of the water would not have to be considered, as this never could rise to a point producing discomfort. Furthermore, the temperature of the water would in most instances be so low that it would be below the dew-point of the air surrounding the body of the subject, and consequently there would be a condensation of moisture on the walls, thus keeping the relative moisture in the helmet or in the submarine boat at a low point.

Compulsory Regulation of Schoolhouse Construction in the United States

The accompanying chart has been designed by Frank Irving Cooper, a well-known Boston architect, showing the present status of compulsory regulation of schoolhouse construction in this country. This chart was exhibited at the recent meeting of the heating engineers' society and is discussed by Mr. Cooper in the *School Board Journal.*

Mr. Cooper states that the chart is compiled from facts obtained in an investigation made by him during the summer of 1910 of the State laws and regulations in regard to schoolhouse construction. It will be noted that only eight states have passed laws on this subject worthy of the name. Of this number only two, Ohio and Connecticut, have regulations on fireproof construction and only one state, Massachusetts, has passed regulations on fire-retarding construction.

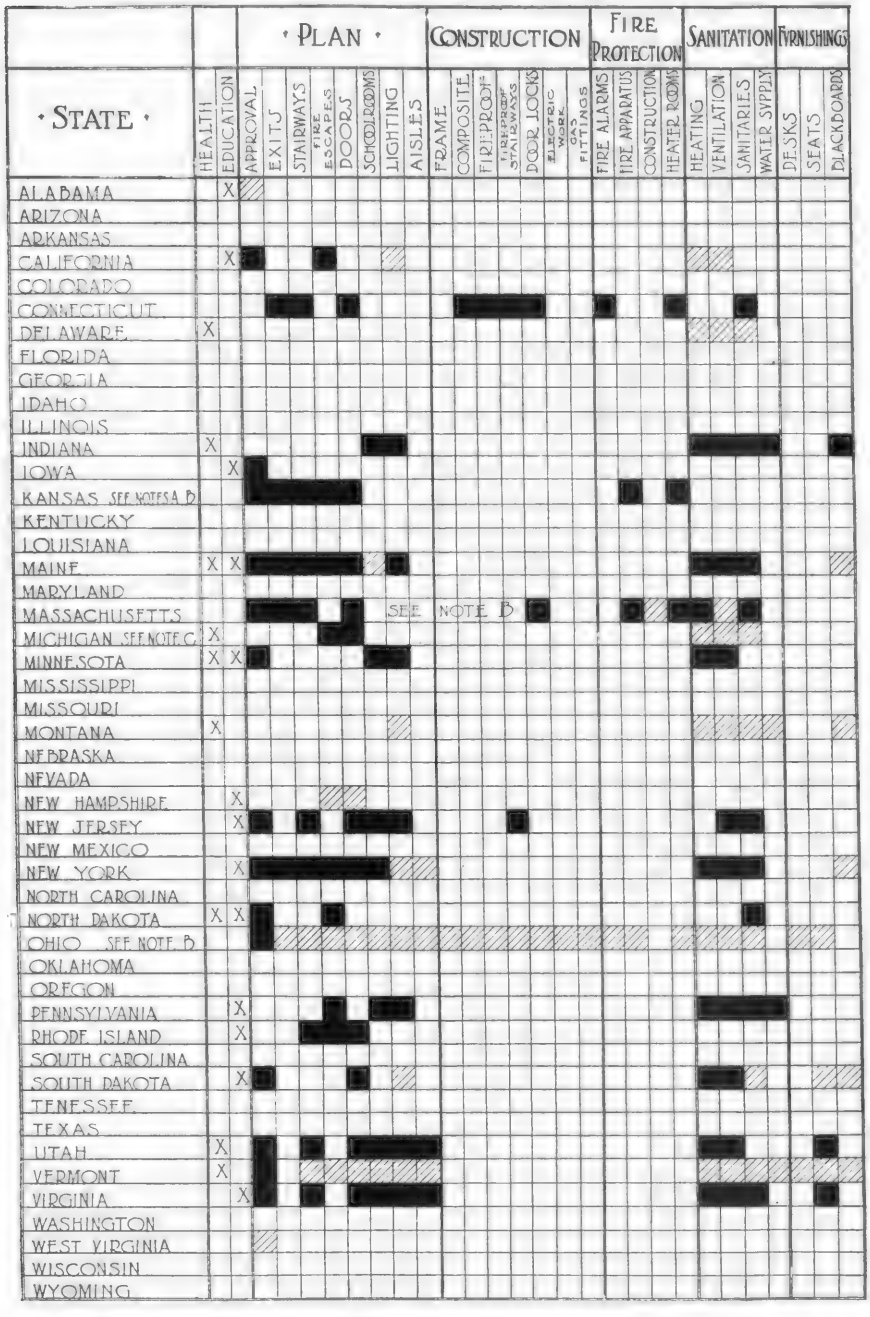
In nine states the control is rested in the boards of health; in thirteen states control through the boards of education, and two states, Massachusetts and Ohio, have regulations through their departments of district police. It should also be noted that the police departments have enforced regulation to a far greater extent than the boards of health and education. Three states have a dual responsibility, as a general principle, but dual responsibility results in confusion and should be deprecated.

In a majority of the cases the regulations state that plans for school buildings must be submitted to a superintendent or other authority for approval.

"This," observes Mr. Cooper, "means a control by men and not by

CHART SHOWING STATUS OF COMPULSORY REGULATION OF SCHOOLHOUSE CONSTRUCTION IN THE UNITED STATES IN 1910.

COMPILED BY FRANK IRVING COOPER,, BOSTON.



X. INDICATES DEPARTMENT CONTROLLING THE ENFORCEMENT OF THE LAWS

NOTE A. THE PLANS FOR SCHOOL BUILDINGS IN THIS STATE MUST BE APPROVED BY STATE ARCHITECT

NOTE B THESE RULES ARE PREPARED BY THE DEPARTMENT OF INSPECTION OF WORKSHOPS FACTORIES AND PUBLIC BUILDINGS

NOTE C. THESE LAWS AND REGULATIONS APPLY TO STATE BUILDINGS ONLY.

■ INDICATES LAW ▨ INDICATES REGULATION

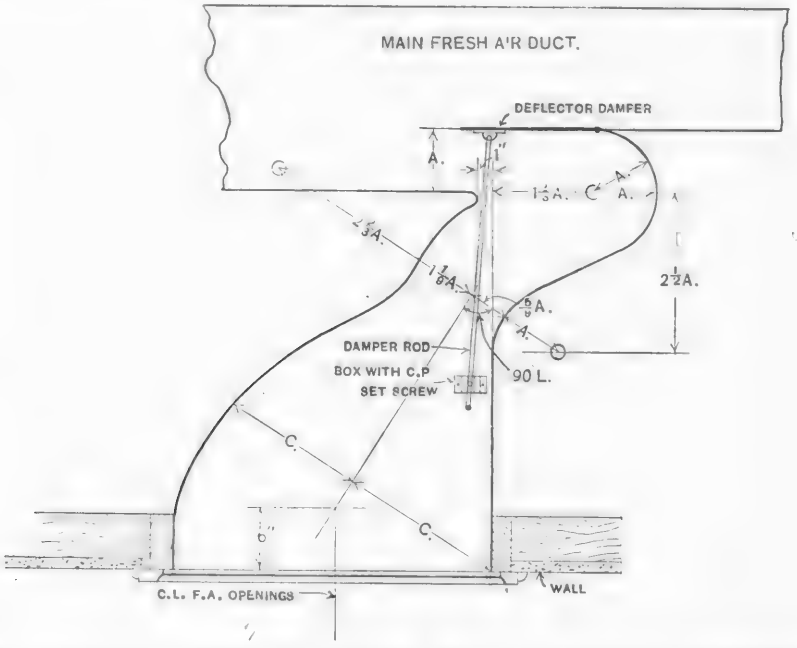
law; it opens the way to corruption and favoritism or at best to regulations that are changed with the ideas or change of administrators. The present tendency to put the responsibility of making the law on the shoulders of inspectors, commissioners or trustees and the tendency to allow each sub-authority to make rules for his own district is filled with evil possibilities.

"Each state should pass school-building laws to govern the construction of all of its school buildings, and these laws should be administered by a strong general authority with as many inspectors as may be needed to cover the work."

The Transmission of Air and Its Movement in Ducts

In THE HEATING AND VENTILATING MAGAZINE for January, 1911, there appeared an article, under the above heading, by Geo. W. Knight and Perry West, discussing, among other important matters in connection with this subject, the development of a new and efficient method for the distribution of air from the main ducts out to, and through, the fresh air openings to rooms, etc.

Results of these tests showed that this particular form gives a very even velocity over the entire area of the opening, even with such reductions in velocities of from 1,500 ft. per minute in the main duct, to 250 ft. per minute through the opening.



WORKING DRAWING OF FRESH AIR OPENING USED TO OBTAIN EVEN DISTRIBUTION OF AIR FROM DUCTS INTO ROOMS

We are glad to be able to reproduce herewith a working drawing of the connection used in this method of distribution, and to say that the form shown is the result of a series

The large pocket, into which the air passes as it leaves the main duct acts as an air cushion and reduces the velocity without shock or radical deflection.

The gradually expanding nozzle tends to convert velocity head into static head, thus creating a pressure with expels the air at right angles to the opening into the room. Inasmuch as the static head created is greater than the friction head through the connection, no static pressure is created in the main duct, and, consequently, no extra power is necessary for forcing the air through this connection.

Effect of Concrete on Heating Mains

Instances of the rapid deterioration of heating mains when imbedded in concrete were reported by several speakers at the recent meeting of heating engineers in New York. F. A. Waldron, for instance, stated:

The Chateau Frontenac, Quebec, has recently built an addition of reinforced concrete construction, with cinder fill between the concrete and wood floors. In this cinder fill are imbedded lines of extra heavy galvanized iron pipe. The manager of the hotel showed me two pieces of this pipe, one the size of the original and one a piece that had been in for less than two years. The exterior of the piece that had been imbedded in the cinder had been eaten away, not pitted, but actually laminated, to one-half the thickness of the original pipe. You could take a jackknife and peel off scales of rust from ¼-in. to 1-in. in length.

The cinder concrete was made of ashes and cement and a little sand, the usual mixture. After making a few inquiries I found that the hotel had its own electric light plant, direct current. Evidently that pipe had a leak in it at some point or had been placed in the concrete and allowed to dry. The combination of circumstances there had produced this exterior corrosion.

Mr. A. B. Franklin: I remember a case twenty-five years ago where I told a builder to be sure to keep the cement away from the pipe. "Why," he said, "I have just taken out a steel beam that has been in twenty years and it is as bright and clean as when it was put in." I said, "Oh, yes, that is one thing, but your wrought-iron pipe underneath the floor of this café, where it is going, is no comparison whatever. Don't let that cement come in contact with this pipe." But he was an old builder and could not be told anything, so he laid the pipe in cement. In six months' time the waiters in that café were going around with swollen feet because the floor was so hot. We had to take up the floor and put in brass pipe, although I advised otherwise.

Mr. Waldron: I would like to correct an impression that has gone forth in regard to the laying of pipes in cement. The question that was brought up referred to the use of pipes buried in cinder concrete. Cinder concrete is naturally more or less porous and I presume there is more or less sulphur in the cinders; also its capacity for absorbing moisture is much greater than the ordinary concrete composed of sand and gravel. But, as a general principle, I do not think it would be advisable to imbed pipes subject to expansion and contraction in a solid mass, because in time it would work itself loose. I do not think there is as much trouble with pipe corrosion when buried in a straight concrete of cement and sand and broken stone as when imbedded in a cinder concrete, which is the fill usually used in a concrete building, between the main floor slabs and the wood floor. Tar concrete is much better for this purpose.

Prof. Wm. Kent: In the steel works in Pittsburg many years ago it was a practice to extend the works on made ground and this made ground was composed chiefly of old cinder piles. There it was the universal custom, when running a pipe through that made land, to imbed it in about 1 sq. ft. area of yellow clay, so as to protect it from corrosion due to the sulphur in the cinders. I do not think that pipe should be laid in cinder concrete unless it is thoroughly protected from the cinder concrete.

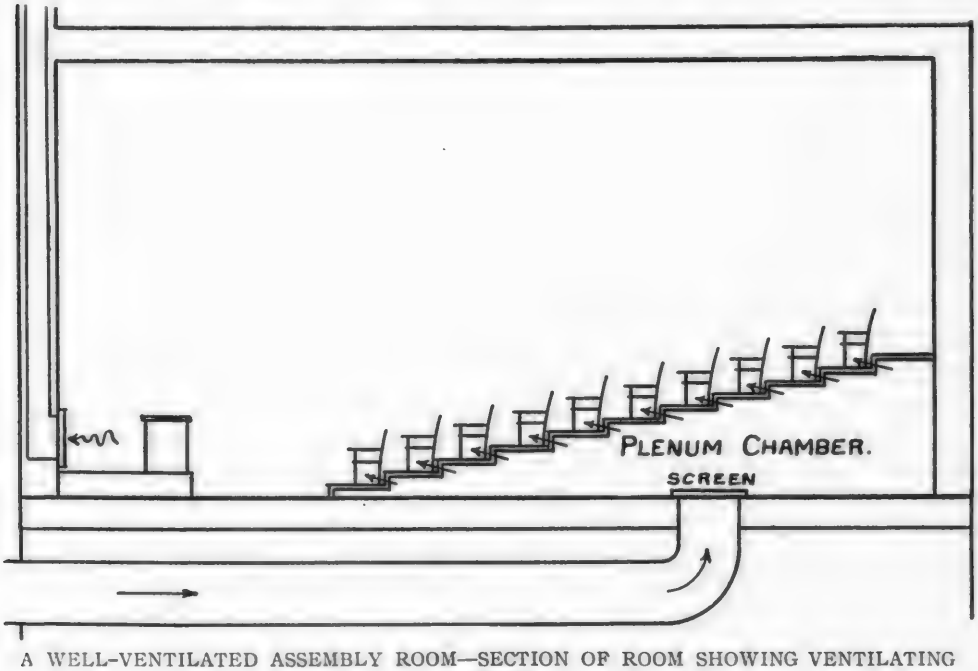
MR. F. K. DAVIS: I have seen electric conduits taken out of cinder cement that were as badly corroded as any pipe shown here to-day. Those pipes were originally coated with an asphaltum compound, but they were simply honeycombed, and it seems to be the opinion of many that free acid in the cement, in addition to the sulphur in the cinder, was the corroding influence.

A Well-Ventilated Assembly Room

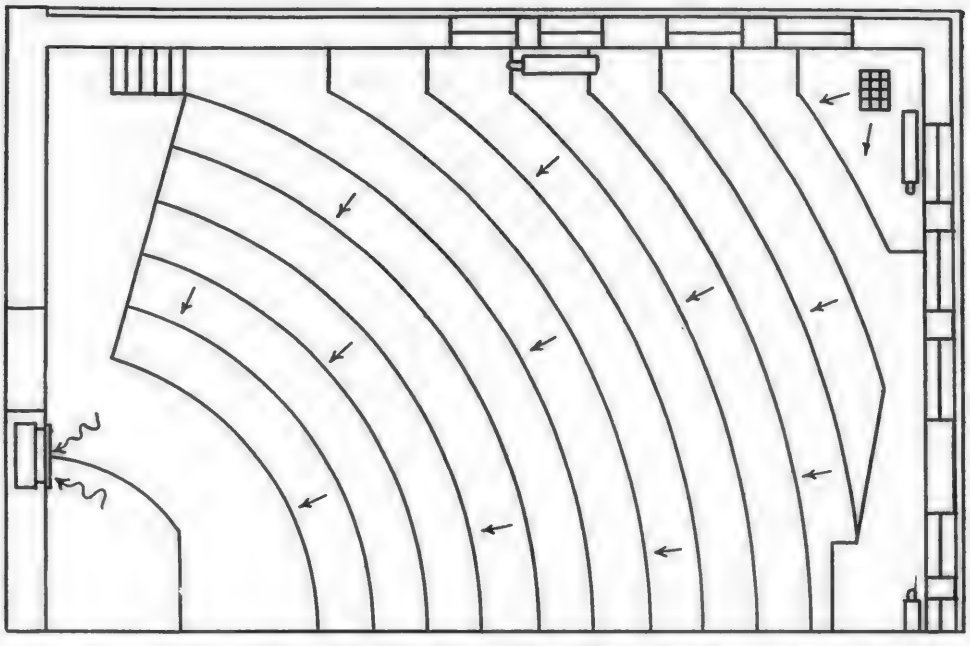
Discussing the matter of air currents in rooms and their effect on ventilation at the recent heating engineers' meeting, Prof. James D. Hoffman cited a case of a particularly-well ventilated lecture room at Purdue University, Lafayette, Ind.

"In some of the lecture rooms at our university" said Prof. Hoffman, "having capacities varying from 300 to 400 students, we have found it a difficult matter to obtain a uniform circulation and distribution of pure air in all parts of the room. In most cases the rooms have raised seats. In our last effort we adopted the old-fashioned scheme of opening up one large duct with a full supply of air into the space below the raised floor, having the air outlets in the rises below the seats, as shown in the accompanying illustration. This space below the raised floor serves as a plenum chamber. The openings into the room are 1-in. diameter and are pitched upward so that the air will not strike the floor. The number of openings is sufficient to permit the required amount of air to enter at a velocity so low that it can scarcely be noticed 1 ft. from the opening. All the air is exhausted at the front of the room near the floor through large registers leading to the attic.

"We have so far made no tests in this room for carbon dioxide, but I know of a number of people who claim to have fair discernment in the matter of pure air, who have come into the room from the fresh outside air on both cold and warm days, and who say that they can detect little or no odor after a class of 300 men have been in the room for an hour. I myself have tried it and I could detect just the slightest odor upon entering. This is a fairly severe test, since the vent registers are located by the side of



A WELL-VENTILATED ASSEMBLY ROOM—SECTION OF ROOM SHOWING VENTILATING SCHEME



A WELL-VENTILATED ASSEMBLY ROOM—PLAN OF HALF OF ROOM, SHOWING COURSE OF AIR TO EXHAUST OUTLET

the doors and all the vitiated air passes these points. The circulation at the back part of the room near the top, where we would expect the most impure air, is probably the best.

"This merely goes to show that the practice of admitting the plenum air from underneath the seats through a large number of small openings and withdrawing it from the front of the room by natural circulation to the roof, is giving first-class satisfaction with us."

Over-Dryness of Air and Its Result

A trying condition incident to hot blast heating, and one which as a matter of hygiene should have special attention in hospitals, is the excessive dryness of the air delivered. A high thermometer reading does not necessarily mean a comfortable room. It is the "sensible" heat which should be regarded and this depends upon humidity conditions. An over-dry room will seem chilly because it produces abnormal evaporation from the skin, but at even lower temperatures it will be pronounced comfortably warm if the air is suitably moistened. The average outdoor air in winter has a moisture content of only about 2 grains per cubic foot, and when this air has been carried past steam coils and expanded by the heat it is frequently found to have a relative humidity of but 25 per cent. at 70°.

Much has been said and printed about the debilitating and injurious effects of over-dry air. Unless moisture is artificially added to the supply, it will quickly absorb what moisture it can from anything in the room. This results in an unnatural dryness of the skin and a parching of the throat of every person who is obliged to remain in such atmosphere. While these are only symptoms of discomfort, the cause should not be tolerated because it not only produces headache and mental lassitude, but an irritated condition of the mucous lining of nose and throat which greatly aids the chances of infection from air-borne diseases. From the standpoint of public hygiene, therefore, ventilation should be made either a part of or an adjunct to every heating plant and the ventilating equipment should include a means of cleansing and moistening the air.

Turbine Blower Tests for Forced Draft

Some remarkable results are reported in connection with tests of a turbine blower, made by the Exeter Machine Works, Exeter, N. H., in connection with forced draft for boilers. This blower is so small that the directions for operating it state simply that it should be placed against the side of the boiler, connected to a small steam pipe and set to blow in under the grates. A damper is placed on the discharge to regulate the air supply and deflect it to the ash pit floor, so that the current is uniformly distributed in the chamber. If necessary it has been found practicable to place the turbine in the rear or on top of the boiler or on a bracket on the wall and thence connected with the space underneath the grates.

In one test at the plant of the Boston Woven Hose and Rubber Co., Cambridgeport, Mass., a turbine blower was used on a boiler burning a mixture of anthracite wharf screenings and New River coal in the proportion of 1 to 1. The leading results as to economy were as follows:

Water evaporated per pound of coal as fired, 8.64 lbs.

Water evaporated from and at 212° F., 10.35 lbs.

Cost of fuel used in evaporating 1,000 lbs. of water from and at 212° F. (note high cost of screenings), $0.146.

Reduction of coal cost due to turbine blowers, $27.60 per day.

In a further test at the same plant, data and results were obtained of the evaporation in a 72-in. x 18 ft. horizontal return tubular boiler, with turbine blower, the forced draft registering 1½ in. pressure. The boiler contained 1,614 sq. ft. of heating surface and 36 sq. ft. of grate surface. In this test, made Feb. 21, 1911, wharf screenings and New River coal were used in equal parts:

Duration, hrs.	8
Weight of coal as fired ½ and ½ screenings and New River, lbs.	4,600
Percentage of moisture in mixture	5
Dry coal consumed, lbs.	4,370
Ash, lbs.	685
Percentage of ash in dry coal	15.6
Total water fed and evaporated, lbs.	39,668
Equivalent water evaporated from and at 212° F., hourly quantities, lbs.	4,958
Dry coal per hour, lbs.	546
Dry coal per hour, per sq. ft. of grate, lbs.	24.26
Water evaporated per hour, lbs.	4,958
Equivalent evaporation per hour from and at 212° F., lbs.	5,950
Steam pressure by gauge, lbs.	100
Temperature of feed water, deg. F.	58
Temperature of flue gases, deg. F.	492
Force draft in uptake, in.	0.34
Force of draft in ash pit (1.22 in.-300 cu. ft. per lb. of coal) in.	1.22
Quality of steam (assumed)	Dry
Horse power developed	172.4
Rated H. P. on 12 sq. ft. basis	134.5
Percentage of rated H. P. developed over rating	21.9
Water evaporated under actual conditions per pound of coal as fired, lbs.	8.64
Water evaporated per pound of dry coal, lbs.	9.08
Equivalent evaporation from and at 212° F. per pound of dry coal, lbs.	10.35
Factor of evaporation	1.2000

COST OF EVAPORATION

Cost of coal per ton of 2,240 lbs. delivered in boiler room (screenings $2.80, New River $4, 13,846 B. T. U)	$3.40
Cost of coal required to evaporate 1,000 lbs. of water from and at 212° F.	$0.146

GAS ANALYSIS

CO_2, per cent.	14.8
CO, per cent.	4.2

In this connection the engineer, J. C. Long, states that he has operated a No. 5 turbine blower at 30 lbs. steam pressure and at this pressure the blower has made 605 R. P. M., which would indicate that they can operate successfully at a low steam pressure.

In this plant the reports show that the boilers were burning 378 tons of coal per week costing $1,512 before the turbine blowers were installed, and that the installation reduced these figures to 336 tons of coal costing $1,344, equivalent to a saving of $168 per week and $8,736 per year.

The gases showed 14 per cent. of CO_2.

John F. Hale, vice-president of the Consolidated Engineering Co., Chicago, has resigned and has become associated with Warren Webster & Co., Camden, N. J.

THE HEATING AND VENTILATING MAGAZINE

Vol. 8 April, 1911 No. 4

PUBLISHED MONTHLY AT
1123 BROADWAY, NEW YORK
BY THE
HEATING AND VENTILATING MAGAZINE CO.
President A. S. ARMAGNAC
Secretary and Treasurer, G. PETERSEN
The address of the officers is the address of this magazine.

A. S. ARMAGNAC, Editor
G PETERSEN, Advertising Mgr.

WESTERN OFFICE:
Monadnock Block, Chicago, Ill.

European Representative:
AMERICAN PUBLICATION BUREAU, 46, Upingham Road, Leicester, England

Subscription, - - - - - $1.00 per year
Foreign countries, - - - - 1.50 " "
Back numbers, - - - - - 15 cents a copy

THOSE who have studied the development of subways as a means of facilitating the movement of people from point to point within the limits of a single city are agreed that it is the coming thing, not only for the larger centers, but for the medium-sized cities throughout the country. Placed in the last few years upon a successful basis as a result of operating and structural devices not before practicable, nearly all of the world's largest cities now possess one or more subways and scores of smaller places are planning them. It is a noteworthy fact that although underground roads were built over fifty years ago, it was not until electric traction became practicable, bringing with it the possibility of good air, that city subways on a large scale were successful. And yet in every case the question of ventilation has been a serious one and has been solved more or less effectively by the use of fans.

This condition of affairs has much of interest for the ventilating engineer, not only on account of its commercial aspects, but also on account of the unusual opportunities afforded for the study of air currents and temperatures under almost every conceivable condition.

An interesting observation, for instance, made by experts after noting a higher temperature in subways constructed some time ago as compared with those built more recently, and operating under similar conditions, is an increase of heat in the older tubes, running from 7° to 10° F. higher than that in the new tubes. The engineers were unanimous in their opinion that the cause of the excessive heating was due to the heavy traffic and to the fact that the capacity of the walls and the surrounding earth to absorb heat becomes, with the passage of time, more and more nearly exhausted. Observations by the managers in one case showed that there was an increase of about 2° F. per year in the temperature of new tubes.

IN ORDER to preserve a proper continuity in the series of articles on central station heating, by Byron T. Gifford, which are commencing in this number, the article on pipe sizes in central station work will be deferred until its logical place is reached in a later issue. Mr. Gifford's first article discusses the matter of line losses and this will be immediately followed, in the May issue, by "Rates in Central Station Heating."

Central Station Heating

I.—PIPE LINE LOSSES.

By Byron T. Gifford.*

THERE are three factors that affect the loss in pipe line operation, and all three are very important: loss from radiation, loss from friction and loss from leaks. These will be taken up separately.

First, Loss from Radiation. This line loss in any underground system is practically constant in steam heating, while in water heating it is proportional to the temperature of the heating medium, and, in both cases, is entirely independent of the per cent. of the capacity being carried in the mains or laterals. In all cases the insulation and pipe line construction affect it to a great extent, especially the drainage of the pipe line to remove, or, better yet, to keep away the surface water or backup water from flooded sewer systems. The depth of the pipe underground also affects the radiation loss.

The author has used as a unit for basing his calculations, 1 sq. ft. of pipe surface underground, including also each square foot of surface in the fittings and specials, such as expansion joints, and all results are given in the radiation loss per square foot of surface per hour. In this work the following table will be found useful for wrought iron and steel pipe:

Size of pipe, inches.	Square feet per lineal foot.
1/8	0.106
1/4	0.141
3/8	0.176
1/2	0.219
3/4	0.276
1	0.344
1 1/4	0.434
1 1/2	0.497
2	0.621
2 1/2	0.752
3	0.916
3 1/2	1.047
4	1.178
4 1/2	1.309
5	1.456

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Size of pipe, inches.		Square feet per lineal foot.
6		1.734
7		1.996
8		2.249
9		2.436
10		2.814
12		3.254
14	O. D.	3.665
15	O. D.	3.760
16	O. D.	4.188
18	O. D.	4.712
20	O. D.	4.736
22	O. D.	5.759
24	O. D.	6.283

The above table is derived from the formula:

$$\text{Square feet} = \frac{\text{External Diam. in inches} \times \pi}{12}$$

The external surface of the fittings and specials should be calculated. There are so many different sizes and shapes it would be impossible to tabulate their surfaces here. Knowing the number of square feet of surface underground and the amount of heat lost per square foot per hour it is a simple matter to figure the heat lost in any underground system by the formula (H=Heat lost in pounds of steam)

$$H = \text{square feet} \times C.$$

Where C is a constant, depending upon the insulation and construction of the pipe line, as well as the temperature of the heating medium.

H. D. Spencer, of Detroit, in Proceedings National District Heating Association for 1910, gives the values for C as follows:

0.051 for 5 lbs. steam lines.
0.086 for 20 lbs. steam lines.

These values are for 4 in. sectional wood log (segmental).

C. R. Bishop, in Proceedings N. D. H. A. for 1910, gives values for C as 0.045, but does not state the pressure or style of insulation. Evidently this value is for the same style of insulation as that reported by Mr. Spencer, but at a lower steam pressure, probably 3 or 4 lbs. These two observations being so close it is probable that the tests were made under about the same conditions.

Tests that the author has made have given him various values for C, from 0.125 to 0.0292, showing a great range of value.

A test on three thicknesses of 2 in. hemlock, with paper lining and shavings, showed, while the insulation was in good physical shape, a value for C as low as 0.0292, but this condition gradually became worse as the insulation became wet and deteriorated. This value is very low and is not often recorded.

The author made a test on the following pipe line with results as follows:

306 ft. 12 in. pipe line.
300 ft. 10 in. pipe line.
481 ft. 8 in. pipe line.
288 ft. 6 in. pipe line.

The value for C was found to be 0.362 during one 98-hour test when the temperature outside was between 20° and 30° F. Steam pressure 3 lbs.

This pipe line was insulated with 1½ in. of asbestos and wool felt and thoroughly water-proofed, as well as underdrained, and this protected on the outside by a 4 in. partition tile conduit, which had a 3 in. air space in it, and placed 4 to 5 ft. underground; i. e., the pipe was 4 to 5 ft. underground.

There is, therefore, only one conclusion we can come to in this case, and that is, that C is a decidedly variable quantity. There is no accurate way of arriving at a value of C except by experiment, but the author uses values given below in his calculations:

Description of insulation and construction	Value of C*	
	Steam at 5 lbs.	Water average
Hemlock lumber, three 2 in. thicknesses, paper and shavings....1st year	0.03	0.02
Same....3rd year	0.05	0.03
Same....5th year	0.08	0.06
Same....8th year	0.10	0.07
Hemlock lumber, two 2 in. or three 1 in. thicknesses, no paper or shavings....1st year	0.05	0.03
Same....3rd year	0.07	0.05
Same....5th year	0.09	0.06
Same....8th year	0.10	0.07
4 in. segmental wood log, tin lined, well underdrained. 1st year and as long as in good condition....	0.04	0.025
4 in. concrete conduit, 1 in. covering....	0.08	0.06
4 in. concrete conduit, 1½ in. covering....	0.05	0.03
4 in. concrete conduit, 2 in. covering....	0.04	0.025
4 in. brick conduit, 1 in. covering....	0.08	0.06
4 in. brick conduit, 1½ in. covering....	0.05	0.03
4 in. brick conduit, 2 in. covering....	0.04	0.025
4 in. partition tile conduit, 1 in. covering....	0.07	0.055
4 in. partition tile conduit, 1½ in. covering....	0.04	0.025
4 in. partition tile conduit 2 in. covering....	0.034	0.020
Two 1 in. thicknesses lumber with 3 in. concrete envelope....	0.05	0.03
Tunnel construction 2 in. covering....	0.045	0.030

*Values of C, are given in lbs. of steam. Multiply this value by 1,000 for heat units value.

All of the foregoing values are used for a dry condition. If wet, it is difficult to assume a value for C.

These values are not absolutely accurate and are not given with that intention, but will be found to be sufficiently correct for estimating purposes.

Some Important Items Affecting Line Loss from Radiation

Drainage. Next to insulation in importance comes underdrainage in its effect on radiation loss. Water will convey heat about eight times as fast as air when confined and for that reason we should try to keep all water, surface or otherwise, away from the insulation and pipe. This can be done by thoroughly waterproofing the conduit and by carrying away whatever water accumulates near the conduit. If the pipe line is laid in a porous soil, such as sand or gravel, the waterproofing of the conduit is sufficient, but in a clay soil some means to carry off the water is necessary.

Lumber insulation will last longer in a clay soil than in a sandy soil, due to the fact that the different conditions of wet and dry will eventually rot the lumber. Lumber under any conditions must be kept dry to be a good heat insulator.

Manholes. Manholes lose more heat per square foot of pipe surface than any other part of the underground system, due of course to the lack of covering. For that reason as few manholes as is consistent should be built. On the other hand, manholes should be over all moving parts such as expansion joints, variators, valves, etc., because of their tendency to leak and cause a very bad condition. A steam leak not only loses heat but it rusts the pipe and deteriorates the insulation and is liable to effect a large section of line before it is discovered.

Heat Losses Due to Leaks. This cause of loss is probably more serious than is at first supposed, according to Napier's Approximate Rule.

$$S = \frac{Pp \times A}{70} = \text{Pounds of steam per second which will pass through a hole.}$$

where Pp = Pressure absolute in the pipe.

A = Area of opening.

$$S = \frac{Pp \times A \times 3600}{70} = \text{Pounds of steam lost per hour.}$$

Assume a ¾ in. hole in a pipe or fitting or assume a number of smaller holes whose aggregate leakage is equal to ¾ in. in diameter in a 5 lb. steam line.

$$S = \frac{19.7 \times .44 \times 3600}{70}$$

$$= 445.7 \text{ lbs. per hour.}$$
$$= 10{,}696 \text{ lbs. per day.}$$
$$= 320{,}904 \text{ lbs. per month.}$$

Assuming, also, an evaporation of 7 lbs. water per pound of coal we have:

45,843 lbs. coal per month, or 22.9 tons.

From this it is quickly seen that it is absolutely necessary to have a tight pipe line for economical operation.

The same case holds true in hot water heating.

Assume the loss of 1 bbl. or 400 lbs. of water per hour from the flow line at a temperature of 170° F. and under ordinary conditions the water is raised from 40° to 170° F. from the well to the flow line or 130° F.

$$400 \times 130 = 52{,}000 \text{ B. T. U.}$$

If this leak should be on the return line it would be $400 \times 110 = 44{,}000$ B. T. U. per hour that we would lose, which, assuming 7,000 available B. T. U. per pound of coal, would show us the following result at the coal pile:

1 bbl. leakage per hour from flow line=2.67 tons per month.

1 bbl. leakage per hour from return line=2.19 tons per month.

This shows us the cost of a small leak and it would pay well to fix it and fix it at once.

A tell-tale pump or indicator should be installed on every water pipe line at the station to detect any leak. Very little trouble is to be expected from the loss of water from theft owing to the condition of the water after circulating, but the tell-tale will indicate any leak and should be installed.

Mr. Gifford's next article will appear in the May issue and will discuss "Rates in Central Station Heating."

Reasonable Heating Requirements for New York's Surface Cars

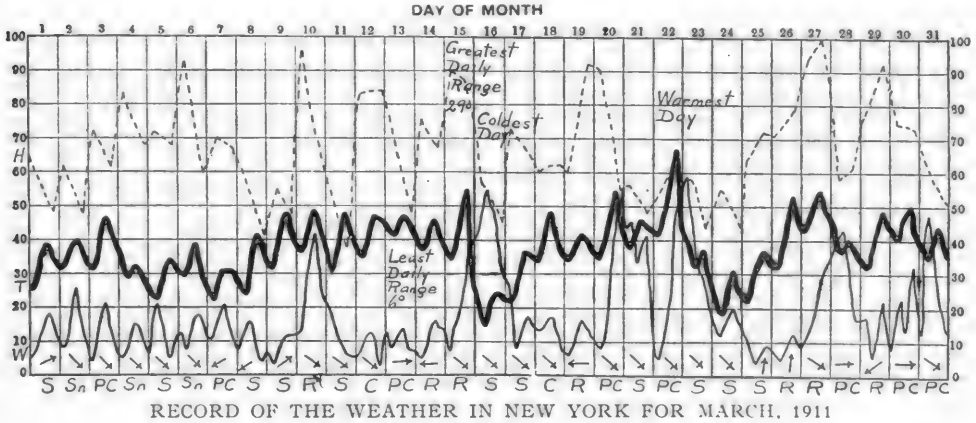
The close of another heating season calls renewed attention to the operation of the heating regulations for New York's surface cars which were promulgated by the Public Service Commission of the First District. Experience has shown that the regulations, which are given in full herewith applicable to electric cars, can be complied with in weather conditions usually prevailing during the winter in New York:

1. All closed cars for the transportation of passengers between the 15th day of October and the 15th day of April in each year shall be equipped with suitable apparatus for heating by electricity.

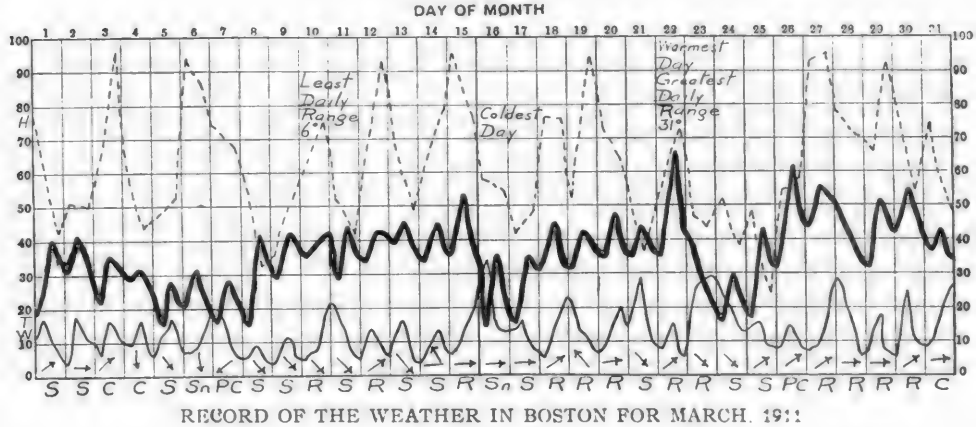
2. Every company during the period above-named, whenever the outside temperature is less than 40° F., shall maintain in all closed cars in service for the transportation of passengers a temperature of not less than 40° F. nor more than 65° F. unless the company is temporarily prevented from so doing by storm, accident or other controlling emergency for which it is not responsible and which is not due to any negligence on its part.

The Weather for March, 1911

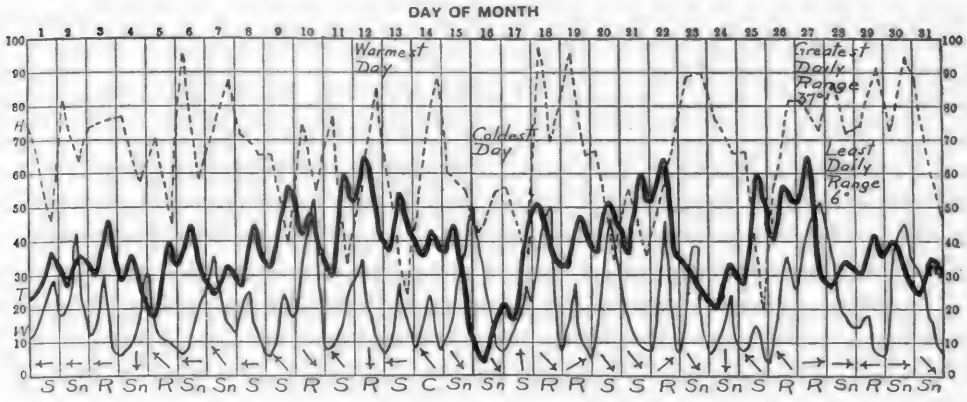
	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	67	66	66	73	80
Date of highest temperature	22	22	12	21	11
Lowest temperature, degrees F.	16	14	4	13	21
Date of lowest temperature	16	16	16	16	16
Greatest daily range, degrees F.	29	31	37	32	38
Date of greatest daily range	15	22	27	15	12
Least daily range, degrees F.	6	6	6	3	8
Date of least daily range	13	10	28	6	7
Mean temperature for month, degrees F.	44.5	35	37	39	47
Normal mean temp. this month, deg. F.	45.1	35	39.5	34.4	44
Total rainfall, inches	2.87	2.95	1.9	1.45	2.22
Total snowfall, inches	2.8	3.1	7.3	4.9	3.5
Normal precipitation this month, inches	4.1	4.08	3.01	2.55	3.43
Total wind movement, miles	11217	9535	11408	11706	9411
Average hourly wind velocity, miles	15.1	12.8	15.3	15.7	12.6
Prevailing direction of wind	N. W.	West	West	South	S. E.
Number of clear days	9	13	10	11	15
Number of partly cloudy days	14	6	7	9	6
Number of cloudy days	8	12	14	11	10
Number of days on which rain fell	11	14	21	10	8
Number of days on which snow fell	4	2	11	5	2
Snow on ground at end of month, inches	None	None	Trace	Trace	Trace



RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1911



RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1911



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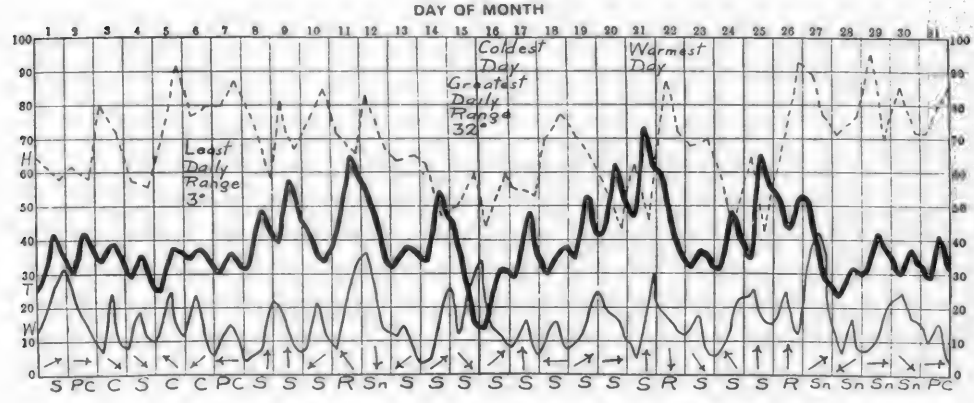
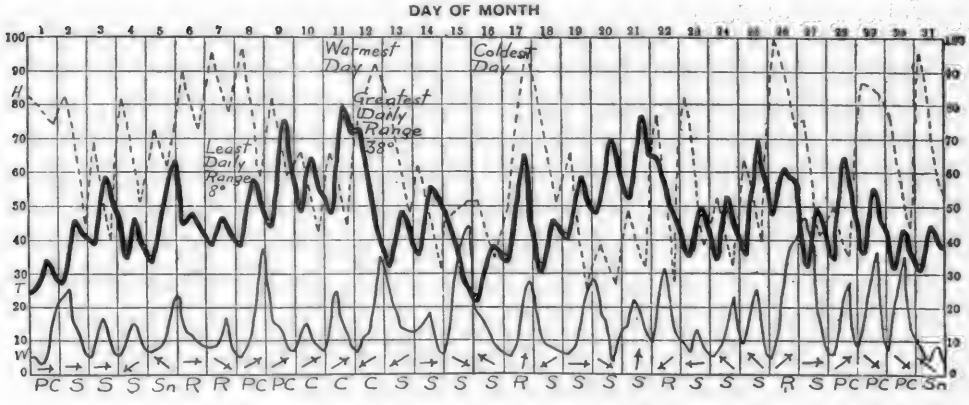


RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1911



RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1911

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A.M. and 8 P.M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—Snow.

Arrows fly with prevailing direction of wind

Legal Decisions

Contract for Installation of Heating Plant—Waiver of Time Limit

An action was brought to recover upon a written contract for the installation of a heating plant of $4,050. The specifications showed a system of heating and ventilating, consisting of fans, engines, heaters, pumps, pipings, etc., to be furnished by the plaintiff, with the exception of some galvanized iron pipe, which was to be furnished by a third party. The contract provided that the plant was to be completed December 1, 1906. It also provided that the defendant was to build the foundations upon which the machinery was to rest, make steam and drip connections from the heaters and engines, do whatever cutting and patching was necessary, furnish common labor and lay tile pipings. It was further agreed that the plaintiff should not be liable for delays occurring without its fault and that "all dates of shipment are contingent upon strikes, accidents or delays of carriers or other causes unavoidable or beyond our control."

The work proceeded in about the usual manner. The defendant, however, asserted that the apparatus was not shipped in good time. The plaintiff answered that the foundations were not ready. The defendant replied that this failure was due to the fact that it could not get the plans from the plaintiff. The work progressed almost to completion, when it was stopped on January 16, 1907, by the defendant because of the alleged insufficiency of the galvanized iron pipe furnished by the sub-contractor. Some of the objections to this pipe were not justified, but the plaintiff was endeavoring to remedy all of the alleged defects when it received a letter from the defendant cancelling the contract.

The position of matters as stated by the court was therefore as follows: The defendant had the plant and had been using it since it was installed; it also had the money it agreed to pay for the plant. The plaintiff had nothing.

The principal contention of the defendant was that the action should have been upon a *quantum meruit* instead of upon the contract, as required by the New York Code of Procedure. The court held that the defect was not vital, as the complaint fully set out the facts, and stated that it would not strain unduly the rules of evidence or of pleading to continue a situation so inequitable.

The delay in completion being due in part to the defendant's action and it having permitted the plaintiff to proceed until near completion, the jury were amply justified in holding the general time limit waived. Judgment for the plaintiff was therefore affirmed.—U. P. Pratt Laboratory vs. Buffalo Forge Co., Circuit Court of Appeals, 184 Fed., 287.

Assignability of Steam Heating Contract

The owner of a large office building entered into a contract with a corporation, whose business was furnishing steam from a central plant for heating purposes, to furnish steam for the building at the rate of 50 cents per 1,000 lbs. of condensation, measured by meter, subject to the following conditions: (a) It was agreed that the total amount of the net bills rendered during any one year should not exceed $1,065; (b) that if, during the life of the contract, the rate charged by the heating company to any consumer in the neighborhood of the owner's premises, consuming as much or less (but not more) steam as the owner, should be less than the rate above specified, the owner's rate should be reduced to such lower rate.

The contract contained various rules and regulations and covered a period of five years with a renewal for a similar period unless cancelled.

About two years and a half after the contract was entered into the owner sold the building to the complainant and assigned in writing the heating contract. The defendant, the heating company, wrote to the complainant that it would furnish steam to the building on a strictly meter basis, and that it had no contract with the owners of the building, enclosing a blank contract for signature. The blank contract was an exact duplicate of the contract with the original owner, except as to the provisions (a) and (b).

The parties were unable to agree. Complainant filed a bill to restrain the defendant from refusing to furnish steam as provided in the original contract. Both parties agreed that the sole question involved in the case was whether the heating contract was assignable and passed, with all its benefits and privileges, to the complainant by virtue of the assignment thereof. The complainant insisted that it was assignable, while the defendant insisted that it was of such a personal character as to be unassignable. The Michigan supreme court held that the contract was assignable.—Voigt vs. Murphy Heating Co.

Surply of Steam for Heating — Rights and Liabilities of Corporation Holding Franchise

A corporation organized to manufacture and sell electric light, heat and power to the occupants of a city secured from the city franchises authorizing it to carry on its business therein. In pursuance of this authority it installed pipes and other appliances through the streets

to supply heat by means of steam. Property owners and occupiers installed in their buildings pipes, radiators and other steam-heating fixtures and appliances which they connected with the company's pipe lines, and for years the company supplied them with steam. During that time these parties obtained electric current for lighting purposes from another electric light company. A leasing company carried on the business of supplying steam which the heating company had contracted to furnish. In 1907 the leasing company served upon consumers a notice to the effect that steam would not be supplied for heating purposes to any party or parties unless they should at the same time use electric current supplied by the heating company for lighting the premises in which steam obtained from that company was used for heating. The plaintiffs brought suit against the heating company and others to enjoin them from enforcing this condition. A defense of the company was that its principal product was electric current for light; that in manufacturing this current during certain portions of the year steam was employed; that the exhaust steam was used in supplying heat; that this exhaust was limited in its amount; that the heat supplied from this source was not more than sufficient to supply patrons of the company who purchased from it current for lighting purposes; and that, if the defendants were required to furnish heat to others than the company's patrons taking light, it would be compelled to generate live steam, which would increase the expense of operating its plant.

Judgment for the plaintiffs was affirmed on appeal. The court said that quasi public corporations like the defendant company must, in consideration of their franchises, serve the inhabitants of their territory without discrimination; but have the right to prescribe for their convenience and security and the protection of the public such rules and regulations, with which their patrons must comply, as are reasonable and just. The condition which the defendant company imposed was an unreasonable and unwarranted one. It was the privilege of its patrons to determine whether they desired one or both of the commodities which the company manufactured and sold, and a condition which imposed an obligation to take both or neither was not only unreasonable, but capricious arbitrary, oppressive and discriminatory.

The defendant company contended that if the steam-heating proposition were to be run independently it could not be operated at a profit and that the defendants should not be compelled to furnish a by-product of the electric light plant unless it was furnished in conjunction with the principal product, electricity. The court held that the business of the company so far as the two products were concerned was separate and distinct. It did not secure a franchise from the city merely to furnish heat from a by-product or exhaust steam, but obtained the right to place and maintain underground lines of pipe under and through the streets "for the purpose of conducting, transmitting and distributing heat, either hot water or steam, for the purchase and use by said city and the residents and citizens thereof." It could not excuse its proposed action on the ground that furnishing steam alone would entail a loss which could be avoided, if electric current were also taken by the consumer for lighting purposes. Neither would it be permitted to impose the condition that a consumer must purchase both of its products in order that its profits might be increased or loss prevented. In passing upon the condition in the notice the court limited its remarks to the condition under the facts of the case relative to the subject under consideration.—Seaton Mountain Electric Light, Heat & Power Co. vs. Idaho Springs Inv. Co., Colorado Supreme Court.

Architecture and Building Show in New York, May 6-13

What is characterized as the first conference of architecural, engineering and building and contracting interests ever held, will inaugurate the opening of the New Grand Central Palace, at Lexington avenue, 46th and 47th streets, New York. The undertaking will be formally known as the New York Architecture and Building Show and will go on during the week of May 6-13, 1911. The show is a movement in the direction of developing a closer relationship between the architectural and engineering interests in the building trades.

Under the lead of a number of professional and technical associations a series of conferences are being planned in connection with the show in which problems confronting architects and engineers will be discussed by experts.

The exhibits already arranged for will be large and varied, assuring the success of the show. They will be designed primarily for the inspection of the professional or technical man rather than the public, although hours will be set aside to admit the public during each day of the exhibit.

The New Grand Central Palace, in which the show will be held, is now approaching completion. It is thirteen stories high and occupies an entire city block, having a floor space of over 600,000 sq. ft. It is described as the largest and handsomest show building in the world, the main auditorium, in which the show will be held, rising to a height of 48 ft.

Small Air Balloons Show Defects in Ventilating System

The Chicago Ventilation Commission has been making some interesting tests at the Chicago Normal School with small hydrogen balloons, which were reported by Samuel R. Lewis, at the recent meeting of heating engineers. The balloons, he stated, were balanced by using as weights old rubber tubing, pieces of which can be easily cut off as required to keep the balloon balanced in the air. These are so sensitive that the warmth given off by a human body causes them to rise when they come near a person. A number of the balloons were released in standard school rooms and the course of the air observed.

According to Mr. Lewis, the balloons demonstrated that horizontal diffusion by vertical diffusers is necessary as the current of fresh air usually would pass the length of the room and strike the opposite wall without spreading to any great extent. They demonstrated that the movement of air took place around the cold sides of the rooms almost entirely, and that the center of the room at the floor line was not getting ventilation to any great extent.

"Two ways of ventilating the center of the room are possible," continued Mr. Lewis, "one by delivering the air at that point, as might be done by upward ventilation; the other, by removing the wall currents, as might be done by constructing our buildings better, so that the drop of the currents down the cold surfaces is equalized enough so that the air out in the rooms moves by the fan or flue influence, pushing in or pulling out evenly over the whole room.

"Dr. Evans, of Chicago, believes in currents, and I am a follower of his. We are studying how to make these currents, which exist in all artifically-heated rooms, serve to produce ventilation. I have changed a large number of my own installations from the ordinary registers (dams which stop the air) to diffusers (curves which divert and direct the air with little friction). I have found the change to result in great improvement, as the fresh air is spread out to all parts of the room with the diffusers and does not pass, as before, over the heads of those in the center of the room, to fall along the opposite wall.

"I think we may yet do away with radiators under windows, when windows are tight and insulated. The radiator so located creates a current in the wrong direction, if we desire to obtain properly diffused ventilation, as they create local upward jets of air drawn from the floor and are constantly opposing any downward ventilation scheme. Then, too, the radiators on outside walls are uneconomical, in my experience, because there is a warm spot on the outside wall opposite every radiator. About one-half of the radiant heat from each radiator goes outside and is wasted. When the radiators are on an interior wall, the radiant heat which goes into the wall is still in the building and warms the same. I have installed, perhaps, fifty ventilated class rooms with the auxiliary direct radiators near the outside walls, but not parallel with or against them, and have heard no complaint on account of draft."

To Determine Water Vapor in Air at Different Heights

Announcement is made that the United States Weather Bureau has made progress toward the installation of apparatus, especially optical, for the study of the quantity of water vapor through a wide vertical extent of the atmosphere (as distinguished from the purely local indications of the hygrometer and the psychrometer). Spectroscopic observations with this end in view are to be undertaken by Prof. W. J. Humphreys.

Importance of Outdoor Air Test When Testing for CO_2 Indoors

It is highly important in testing indoor air for the amount of carbon dioxide it contains to have some knowledge of the proportion of carbon dioxide in the air supply. In some tests made of the outside air on the roof of the Custom House in New York City, Mr. Cooley, of the Supervising Architect's Department, found that at this point, which is near the Battery and presumably pretty well wind-swept, the proportion of CO_2 in the outside air ran as high, I think, as 7 parts in 10,000. The importance of this phase of the subject has been recognized in the proposed new law for factory ventilation in New York State. The committee having this matter in charge had to bow to the wishes of other interests which contended that carbon dioxide should be recognized as the vital element in ventilation and we settled on a differential. It complicates the matter by making it necessary to test both the indoor and outdoor air.—*W. W. Macon, before the Heating Engineers' Society.*

Names of Manufacturers Wanted by Illinois Department of Factory Inspection

In connection with the Illinois factory law, which covers, among other things, the matters of heating and ventilation, it appears that many manufacturers in Illinois, although acquainted with the statute, and desirous of complying therewith, have lacked definite information as to how to secure the appliances called for.

To supply this information and thus expedite compliance with the law, the chief factory inspector of Illinois, Mr. Edgar T. Davies, is compiling a list of makers of all appliances used in accordance with this statute. This includes manufacturers of ventilation and sanitation apparatus.

All such manufacturers are requested to send in their names, addresses and list of their appliances, addressing same to Edgar T. Davies, Chief Factory Inspector, Illinois Department of Factory Inspection, 1103 Security Building, Chicago, Ill. The information thus sent in will be published, we are advised, without discrimination of display or position, and with absolutely no expense to any manufacturer represented, the entire expense being borne by the State.

To those who are not familiar with the Illinois factory law, it may be stated that it is entitled, "An Act to provide for the health, safety, and comfort of employees in factories, mercantile establishments, mills and workshops in this State, and to provide for the enforcement thereof." It was approved June 4, 1909, and became effective January 1, 1910.

The sections relating to ventilation and sanitation are as follows:

"Sec. 10. In every factory, mercantile establishment, mill or workshop, where one or more persons are employed, adequate measures shall be taken for securing and maintaining a reasonable, and, as far as possible, equable temperature, consistent with the reasonable requirements of the manufacturing process. No unnecessary humidity, which would jeopardize the health of employees, shall be permitted.

"Sec. 11. In every room or apartment of any factory, mercantile establishment, mill or workshop, where one or more persons are employed, at least 500 cu. ft. of air space shall be provided for each and every person employed therein, and fresh air, to the amount specified in this act, shall be supplied in such a manner as not to create injurious drafts, nor cause the temperature of any such room or apartment to fall materially below the average temperature maintained; provided, where lights are used which do not consume oxygen, 250 cu. ft. of air space shall be deemed sufficient. All rooms or apartments of any factory, mercantile establishment, mill or workshop, having at least 2,000 cu. ft. of air space for each and every person employed in each room or apartment, and having outside windows and doors whose area is at least one-eighth of the total floor area, shall not be required to have artificial means of ventilation; but all such rooms or apartments shall be properly aired before beginning work for the day and during the meal hours. All such rooms, or apartments, having less than 2,000 cu. ft. of ar space, but more than 500 cu. ft. of air space, for each and every person employed therein, and which have outside windows, and doors whose area is at least one-eighth of the floor area, shall be provided with artificial means of ventilation, which shall be in operation when the outside temperature requires the windows to be kept closed, and which shall supply during each working hour at least 1,500 cu. ft. of fresh air for each and every person employed therein. All such rooms or apartments, having less than 500 cu. ft. of air space for each and every person employed therein, all rooms or apartments having no outside windows or doors, and all rooms or apartments having less than 2,000 cu. ft. of air space for each and every person employed therein, and in which the outside window and door area is less than one-eighth of the floor area, shall be provided with artficial means of ventilation, which will supply during each working hour throughout the year at least 1,800 cu. ft. of fresh air for each and every person employed therein; provided, that the provisions of the preceding portions of this section shall not apply to storage rooms or vaults; and, provided further, that the preceding portions of this section shall not apply to those rooms or apartments in which manufacturing processes are carried on which from their peculiar nature would be materially interfered with by the provisions of this section. No part of the fresh air supply required by this section shall be taken from any cellar or basement.

"The following terms of this section shall be interpreted to mean: The air space available for each person is the total interior volume of a room expressed in cubic feet, without any deductions for machinery contained therein, divided by the average number of persons employed therein.

"Outside windows and doors are those connecting directly with the outside air; the window and door area is the total area of the windows and doors of all outside openings; and the floor area is the total floor area of each room.

"Sec. 12. All factories, mercantile establishments, mills or workshops shall be kept free from any gas or effluvia arising from any sewer, drain, privy or other nuisance on the premises. All poisonous or noxious fumes or gases arising from any process, and all dust of a character injurious to the health of the persons employed, which is created in the course of a manufacturing process, within such factory, mill or workshop, shall be removed, as far as practicable, by either ventilating or exhaust devices.

"Sec. 13. All decomposed, fetid or putrescent matter, and all refuse, waste and sweepings of any factory, mercantile

establishment, mill or workshop, shall be removed and disposed of, at least once each day, and in such a manner as not to cause a nuisance; and all cleaning shall be done, as far as possible, outside of working hours; but if done during working hours, shall be done in such a manner as to avoid the unnecessary raising of dust or noxious odors. In every factory, mill or workshop, in which any process is carried on which makes the the floors wet, the floor shall be constructed and maintained with due regard to the health of employees, and gratings or dry standing rooms shall be provided, if practicable, at points where employees are regularly stationed, and adequate means shall be provided for drainage, and for preventing seepage or leakage to the floors below.

"Sec. 28. The provisions of this act relating to sanitation and ventilation shall not be held to apply to such rooms or apartments of any factory, mercantile establishment, mill or workshop, which are being operated under the supervision of the Federal Government, by virtue of an Act of Congress, entitled 'An Act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1907," approved June 30, 1906, or any amendment thereof; nor shall any other of the provisions of this act so apply respecting matters and conditions over which the Federal Government now exercises or shall hereafter exercise jurisdiction."

The law provides that "anyone who shall violate any of the provisions of this Act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished for the first offense by a fine of not less than $10 and not more than $50, and upon the conviction of the second or subsequent offense shall be fined not less than $25 and not more than $200, and in each case shall stand committed until such fines or costs are paid, unless otherwise discharged by due process of law.

The Present Status of Ventilation Requirements in Massachusetts

Speaking at the recent heating engineers' meeting Joseph A. Moore, inspector of public buildings and deputy chief of the Inspection Department, State of Massachusetts, gave an interesting summary of the situation with regard to the ventilation requirements in Massachusetts, which are now on a somewhat different basis from those which have been in effect for many years.

"In Massachusetts," said Mr. Moore, "we were very glad to start in and get what we could at first. The first laws were in rather a crude shape and gradually we kept working for more points. Finally we got a law that worked well until the medical inspectors of the State Board of Health stepped in and for two years deprived us of all authority. Our law now is different from what is generally understood. We have nothing to do at the present time with factories and work-shops. We did have until the authority was taken away from us in 1907, but in 1909 we got back part of our jurisdiction in connection with public buildings."

The law covering this reads:

"Every public building and every school house shall be kept clean and free from effluvia arising from any drain, privy or nuisance, shall be provided with a sufficient number of proper water closets, earth closets or privies, and shall be ventilated in such a manner that the air shall not become so impure as to be injurious to health. If it appears to an inspector of factories and public buildings that further or different sanitary, ventilating or heating provisions are required in any public building or schoolhouse, in order to conform to the requirements of this section, and that such requirements can be provided without unreasonable expense, he may issue a written order to the proper person or authority, directing such sanitary, ventilating or heating provision to be provided.

"A school committee, public officer or person who has charge of, owns or leases any such public building or schoolhouse, who neglects for four weeks to comply with the order of such inspector, shall be punished by a fine of not more than $100.

"Whoever is aggrieved by the order of an inspector, issued as herein provided and relating to a public building or schoolhouse, may appeal to a judge of the superior court, as provided in Chapter 487 of the Acts of the year 1908."

"I will say," continued Mr. Moore, "that the law is that the judge may either hear the case or he may appoint three disinterested persons skilled in the subject matter of the controversy. It allows the calling in of engineers or people that are competent to pass on it."

Inspection on the part of the State Board of Health is made under the following authority:

"The State Inspectors of Health or such other officers as the State Board of Health may from time to time appoint shall make such examinations of school buildings as in the opinion of said board the inspection of the health of the pupils may require. The provisions of this section shall be enforced by the State Inspectors of Factories and Public Buildings."

"There was another law," added Mr. Moore, "enacted in 1909, which gave us more authority. It is contained in Chapter 354, Acts of 1909, and reads:

"The Chief of the District Police, the Deputy Chief of the Inspection Depart-

ment of the District Police, and the Inspectors of Factories and Public Buildings may, in the performance of their duty in enforcing the laws of the Commonwealth, enter any building, structure or enclosure, or any part thereof, and examine the method of prevention of fire, means of exit and means of protection against accident, and may make investigations as to the employment of children, young persons and women, except concerning health and the influence of occupation upon health. They may, except in the city of Boston, enter any public building, public or private institution, schoolhouse, church, theatre, public hall, place of assemblage, or place of public resort, and make such investigations and order such structural or other changes, in said building as are necessary, relative to the construction, occupation, heating, ventilating and the sanitary condition and appliances of the same.

" 'Any person who hinders or prevents or attempts to prevent any member of the Inspection Department of the District Police from entering any building, structure or enclosure or part thereof specified in the preceding section shall be liable to a penalty of not less than $50 nor more than $100.'

"Our department years ago established a standard. It is not law in Massachusetts, but it has been practically accepted. It is practically that there shall be at least 30 cu. ft. of fresh air supplied per minute for each occupant of a school room, and at least that amount of vitiated air removed through the vent ducts, the temperature not to vary more than 3° F. at any occupied part of the room. We generally place our thermometers upon the corner desks and on the teacher's desk, making five thermometers. No uncomfortable draft is to be perceptible and no unsanitary odors shall be noticed in the building and the building must be heated to 70° F. in any weather. Those requirements have been in force for years and are generally observed under that provision of the law conferring on the District Police the authority for enforcing the law."

MR. JAS. H. DAVIS: I would like to ask if that Massachusetts law applies to parochial and private schools?

MR. MOORE: Our law applies to schools seating 10 or more persons at one time. A section of our law reads:

"No building which is designed to be used, in whole or in part, as a public building, public or private institution, schoolhouse, church, theatre, public hall, place of assemblage or place of public resort, and no building more than two stories in height, which is designed to be used above the second story, in whole or in part, as a factory, workshop or mercantile or other establishment and has accommodations for ten or more employees above said story, and no building more than two stories in height designed to be used above the second story in whole or in part as a hotel, family hotel, apartment house, boarding house, lodging house, or tenement house, and has 10 or more rooms above said story, shall be erected until a copy of the plans thereof has been deposited with the inspector of factories and public buildings for the district in which it is to be erected by the person causing its erection, or by the architect thereof. Such plans shall include the method of ventilation provided therefor, and a copy of such portion of the specifications therefor as the inspector may require. Such building shall not be so erected without sufficient egresses and other means of escape from fire, properly located and constructed.

"The certificate of the inspector, endorsed with the approval of the Chief of the District Police, shall be conclusive evidence of a compliance with the provisions of this chapter unless, after it is granted, a change is made in the plans or specifications of such egresses and means of escape without a new certificate therefor. Such inspector may require that proper fire stops shall be provided in the floors, walls and partitions of such buildings, and may make such further requirements as may be necessary or proper to prevent the spread of fire therein or its communication from any steam boiler or heating apparatus.

"Sec. 23. No wooden flue or air duct for heating or ventilating purposes shall be placed in any building which is subject to the provisions of Sections 24 and 25 (the sections refer to buildings such as those already described, coming under the inspection of the fire inspectors), and no pipe for conveying hot air or steam in such building shall be placed or remain within 1 inch of any woodwork, unless protected to the satisfaction of said inspector, by suitable guards or casings of incombustible material.

"Sec. 24. Whoever erects or constructs a building, or architect or other person who draws plans or specifications, or superintends the erection of a building, in violation of the provisions of this chapter shall be punishable by a fine of not less than $50 or more than $1,000."

Ohio Society of Mechanical, Electrical and Steam Engineers

The next semi-annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers will be held in Youngstown, Ohio, on May 18 and 19. Oscar F. Rabbe, Toledo, president; Prof. Frank E. Sanborn, Columbus, secretary-treasurer.

CORRESPONDENCE

New Building Inspection Bill Before Massachusetts Legislature

EDITOR HEATING AND VENTILATING MAGAZINE:

Since the meeting of The American Society of Heating and Ventilating Engineers in New York last January, there has been sent to the Massachusetts legislature a report from a commission appointed last year by Governor Draper and which consisted of a lawyer, a doctor and a woman connected with a women's society, a labor leader and a representative of manufacturers. The commission held meetings last year in different cities at which labor representatives, children's aid society's paid representatives, some general reform doctors, agitators, and part of the inspectors of the district police were present.

The report was very erroneous and misleading and presented to the legislature a bill which provides for an unpaid commission of five members who would have the appointment of a chief commissioner, two deputies, a register and fifty inspectors, ten of which would be women, and women inspectors, many of whom would be physicians. The salary of the commissioner to be not less than $6,000 or more than $8,000. The salary of the others to be fixed by the unpaid commission and to be paid out of the State treasury. The commissioners were to fix the terms of office and could remove at any time any member by a vote of four members.

This bill proposes to give an unpaid commission, to be appointed by the Governor, absolute power. The commission could fix salaries at any sum it desired and the State treasury would be obliged to pay the amount so fixed without requiring the legislature to make an appropriation. The bill also proposes to discharge all the inspectors of factories and public buildings, except the chief and deputy chief. Of the 28 inspectors to be discharged 18 are to be reappointed as building inspectors. This would reduce the number of inspectors by 10 and would turn out men who have had many years of practical experience (some over 20 years), men who are architects, builders and practical experts in heating and ventilation. Also, some who are veterans of the Civil War and who, in that event, could not go upon the veterans' retired list as they can now go.

The bill creates a large force of inexperienced men. Whatever knowledge a man may have as a physician would not qualify him as an expert in matters of heating and ventilation. What could he tell about heating and ventilating plans or specifications? Could a doctor figure the size of boilers, radiation, pipes, valves, sizes and locations of supply and exhaust ducts for ventilation, the sizes and speeds of fans or electric motors and many other things required by a heating and ventilating engineer or contractor?

The bill proposes that these new men have charge of the construction, heating, ventilation and sanitation of all buildings used for industrial purposes, which include factories, workshops, bakeries, mechanical establishments, tenement-house workrooms, and all other buildings in which manufacturing is carried on, and mercantile establishments.

This will create a conflict between the new men and the building inspectors of the district police. Many buildings used on the first floor for mercantile purposes have on the floor above, public halls, moving picture houses, theatres, assembly and lodge rooms that require modern ventilation. This bill will give the doctors authority to approve the building plans and, if they see fit, will allow buildings to be constructed without proper means of exit or means of preventing spread of fire, or having proper and sufficient means of heating and ventilation. All of which are required for the protection and health of the public.

This bill is favored and urged by the same parties who were instrumental in taking from the district police inspectors all authority in matters of heating, ventilation and building construction, and transferring the work to the medical inspectors of the State Board of Health.

The Boston Socety of Architects has appointed a committee which has stated that it is its object to reduce the cost of heating and ventilating apparatus; also to reduce the size of flues for supplying and removing air and also the amount of air supplied. At a meeting of this committee of the architects' association, several doctors were invited to be present, and it was proposed to adopt the practice of ventilating by windows instead of by modern appliances, especially in schools.

The legislature has not yet acted on the proposed bill to establish the industrial inspection department, but its advocates are busily engaged in influencing all the persons they can in favor of the measure. It appears to be theory versus practical knowledge and experience. The chances are, however, that the bill will not pass the legislature.

MEMBER A. S. H. & V. E.

Boston, April, 1911.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Change of Date for Annual Convention

Announcement is made of a change in date of the annual convention of the National Association of Master Steam and Hot Water Fitters which will meet in Chicago. The original dates selected were in June, and the new dates selected are May 29, 30, 31 and June 1, 1911. Headquarters will be at the Hotel Sherman, Randolph and Clark streets. Under the first arrangement the convention would have conflicted with that of the National District Heating Association, which meets in Pittsburg early in June.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

For a Summer Meeting on Lake Michigan

A plan to hold the next summer meeting of the Heating Engineers' Society on the waters of Lake Michigan, first proposed by former Vice-President Samuel R. Lewis, in an after-dinner speech at the meeting of the society in St. Louis last summer, now promises to become a reality. At a meeting of the board of governors of the society, held in the society's headquarters in the Engineering Societies' Building, New York, March 24, the proposal was made to hold the summer meeting on June 27, 28 and 29, 1911, on a three-days' steamship trip on Lake Michigan and Green Bay, and it was decided to canvass the members to learn if a sufficient number could be counted on. Tentative arrangements have been made to charter one of Lake Michigan's leading steamships. The meeting thus promises a highly attractive outing feature. Special entertainment is planned for the three evenings taken up in the journey; proper periods of morning or afternoon are reserved for the technical sessions and a considerable number of stops at important cities and interesting places with perhaps an hour's sojourn in each case are possible.

Twenty-five applications for membership were received by the board and approved for ballot vote.

It was voted to issue during the present year the proceedings of 1909 and 1910. On account of the unusual expenditure involved, it is desired that the increased outgo shall not make inroads on the society's surplus reserve, and it was voted to make an appeal to each member to introduce a candidate before the summer meeting.

National District Heating Association

The committee on data of the National District Heating Association, through E. J. Kiefer, chairman, 31 North 9th street, Easton, Pa., has sent out blank forms to members in an effort to collect information to be included in its report at the forthcoming meeting of the society in Pittsburg, June 5-8. The data desired refer to both steam and hot water central station heating work and cover the number of consumers, rates, number of meters in service, price of domestic fuel, amount of space heated, amount of radiation, rules governing installation, design of system (whether operated in connection with an electrical supply company) and whether the business is profitable at the rates charged. Additional details are asked for various classes of buildings, the points including the total amount of space, total radiation, ratio of radiation to space, average cost per 100 cu. ft. of space, average cost per square foot of radiation, monthly average temperature and monthly average coal consumption.

National Association of Jobbers of Wrought Iron Pipe and Fittings

An attendance of 125 members was registered at the second annual convention of the National Association of Jobbers of Wrought Iron Pipe and Fittings, which was held at the Hollenden Hotel, Cleveland, O., March 14 and 15 last. The organization reported a total membership of 220, representing 90% of the tonnage in pipe and fittings handled by jobbers.

The meeting was presided over by President A. E. Ford, of Ford & Kendig Co., Philadelphia, and the two-days' programme was taken up with reports and topical discussions of various phases of the jobbing business. Among the speakers were W. B. Henion, Chicago; W. M. Pattison, Cleveland; W. L. Rodgers, Pittsburg; J. P. Fell, Buffalo; George W. K. Taylor, New York, and Francis J. Baker, San Francisco.

The following officers were elected: President, C. H. Simmons, John Simmons Co., New York; first vice-presdent, O. F. Felix, Pittsburg Gauge & Supply Co., Pittsburg; second vice-president, A. L. Scott, Pacific Hardware & Steel Co., San Francisco; treasurer, C. G. Cornell, Jr., Cornell & Underhill, New York; advisory secretary, T. James Fernley, Philadelphia; secretary, Thomas A. Fernley, Philadelphia; members of executive committee, W. M. Pattison, Cleveland; F. M. Sheldon, Boston; E. G. Cuyler, Baltmore; C. V. Kellogg, Chicago; Samuel H. Moon, Louisville, and J. P. Hartnett, St. Louis.

Atlantic City was selected as the meeting place for the association in 1912.

Features of the convention were an inspection of the plant of the National Tube Company, at Lorain, O., and a theatre party at the Hippodrome in Pittsburg.

Warren Webster & Co.'s Twenty-Third Anniversary

Upon the occasion of the twenty-third anniversary of the establishment of the business, Warren Webster & Co., Camden, N. J., held a convention of its district managers and engineers from March 6 to 11, 1911. Headquarters were established at the Bellevue-Stratford Hotel, Philadelphia, where the convention was formally opened by a dinner in the evening of March 6, at which covers were laid for forty-six.

A large convention hall was engaged in the Camden Y. M. C. A. building, where morning, afternoon and evening sessions were held for a period of five days, during which an elaborate and carefully prepared program of problems connected with the fields of vacuum steam heating, modulation systems, feed-water heaters and air washers was discussed. Suitable general papers were read by those in charge of the respective departments, while the details were covered in a series of topical discussions.

It was the purpose of the company, through this convention, not only to educate their organization fully in all of the developments which have taken place, but to formulate standards so that the Webster practice would be uniform in all of the sections of the country covered by its twenty-three branch offices.

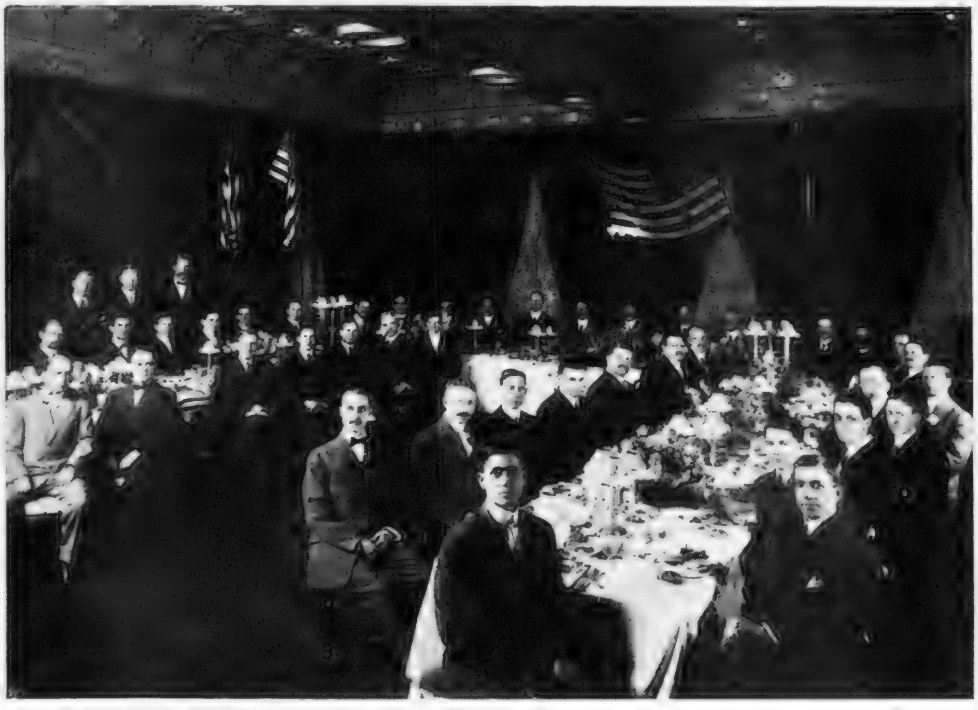
William G. Snow, chief engineer of the company, officiated as chairman of the convention and conducted it strictly according to parliamentary practice. An interesting incident was the presentation to Warren Webster, president of the company, of a handsome silver loving cup, by the district managers.

The photograph shows the delegation while guests of the company at the opening dinner.

Boston's Congress of Technology

The fiftieth anniversary of the granting of the charter to the Massachusetts Institute of Technology was made the occasion of a Congress of Technology in Boston, April 10 and 11. The sessions of the Congress were held in the building of the Institute of Technology, being opened with an address by President Maclaurin, of the Institute, in Huntington Hall. On this and the following day, April 11, an imposing array of papers was presented in the various buildings of the institute, covering practically the entre range of the technical field.

Among the papers of special interest to the heating and ventilating profession were the following:



DINNER TO WARREN WEBSTER & CO.'S ORGANIZATION AT OPENING OF 1911 CONVENTION ON OCCASION OF COMPANY'S TWENTY-THIRD ANNIVERSARY

"Factory Sanitation and Efficiency," by C. E. A. Winslow, Associate Professor of Biology, College of the City of New York.

"Thirty Years' Work in Boiler Testing," by George H. Barrus, Boston.

"The Technical School Man in Public Health Work," by Harry W. Clark, Chief Chemist, State Board of Health, Boston.

The Nason-Vesusvius Steam Trap

In a certain sugar refinery a series of four vacuum pans were all drained into one trap. There was need for increased capacity and talk of installing a fifth kettle to supply the demand. The engineer taking the tip of an engineer salesman suggested drawing each kettle independently and putting a trap on each outlet so that the steam coils could be freed from water as soon as it had condensed. His suggestion was carried out and an increased output of each sugar pan made the total capacity of four pans, with independent steam traps, equal to four and one-half pans with the single trap drain. The cost of the four traps

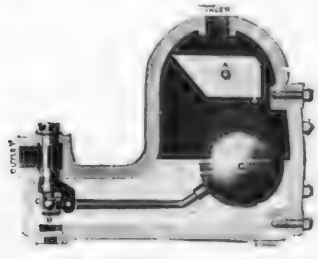


FIG. 1—NASON-VESUVIUS STEAM TRAP, SHOWING BUCKET IN RECEIVING POSITION, VALVE CLOSED

was about one twenty-fifth that of a new pan.

In kiln work and under all conditions where steam is used for drying or cooking purposes, the secret of success is to condense the steam as quickly as possible and get rid of the water immediately.

It will thus be seen that the efficient system is one which is quickly freed from all condensation so that the water can be immediately discharged into the hot well and returned to the boiler, changed into steam and given another charge of a thousand heat units per pound. Among the better class of steam traps is the type known as the Nason-Vesuvius, made by the Nason Manufacturing Company, New York.

Fig. 1 shows the Nason-Vesuvius steam trap in its receiving position; Fig. 2 shows it relieving the system of a charge of water.

The operation of the trap is as follows: Water enters the trap at "inlet" (Fig. 1 and is received in the tilting copper bucket (a). This bucket when empty is maintained in a horizontal position as shown, but when full of water it becomes unbalanced and dumps its charge of water into the body of the trap (Fig. 2). The quick upward impulse imparted to the float C by this discharge instantly removes the ball from its seat. This instantaneous action of the ball in leaving

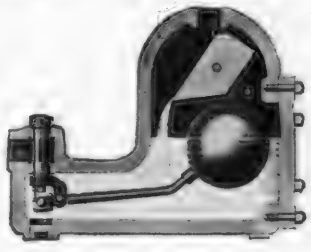


FIG. 2—NASON-VESUVIUS STEAM TRAP, SHOWING BUCKET DUMPING, VALVE DISCHARGING

its seat allows a clear free-way for the discharge.

In closing, the float follows the receding water level and gradually returns the ball toward its seat until a predetermined level is reached. At this point the pressure "picks up" the ball and instantly seats it, thus closing the discharge orifice, until the above described operation is repeated.

As will be observed from the large detail of the valve (Fig. 3) the ball is held in position by cage D (Fig. 1). The stationary and movable pins comprising this cage are so arranged that a positive rotating motion is imparted to the ball with each discharge, thus offering a different surface of the ball at each seating.

It will also be observed that if at any

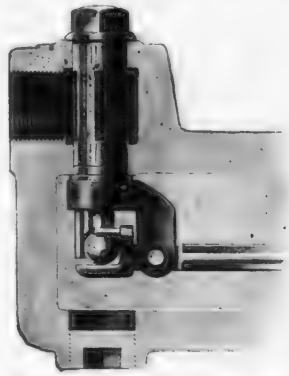


FIG. 3—ENLARGED VALVE DETAIL OF NASON-VESUVIUS STEAM TRAP

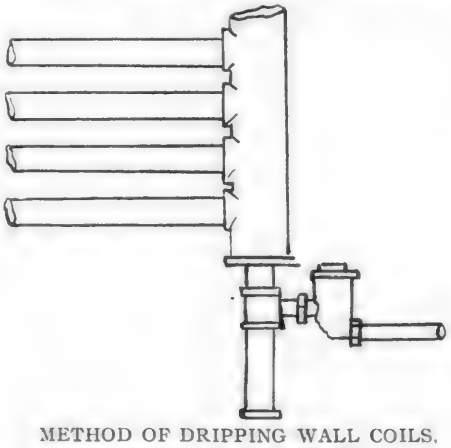
time it is necessary to repair the trap, a new ball and seat can be put in in a few minutes' time and at a very small cost.

Catalogues containing very full descriptions of this trap as well as of the company's other specialties will be sent to those asking for them by the Nason

Manufacturing Company, 71 Fulton street, New York. The company also offers the services of its engineering department in solving any trap problem which may confront the engineer.

Heating System for the Doherty Silk Mill, Paterson, N. J.

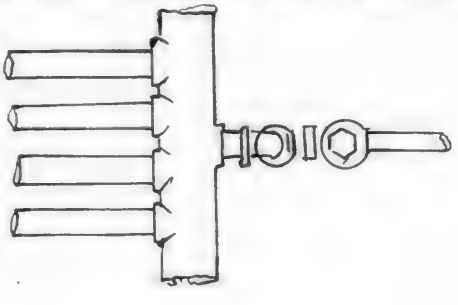
The Doherty Silk Mill, in Paterson, N. J., is a four-story building of unusual length, measuring no less than 466 ft. 8 in. by 55 ft. wide. The heating throughout is by means of direct steam coils,

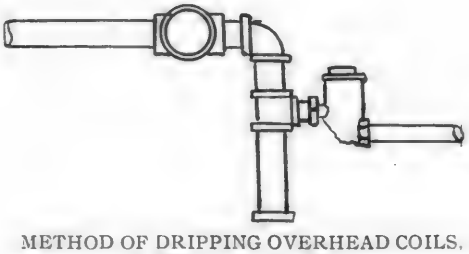


METHOD OF DRIPPING WALL COILS, DOHERTY SILK MILL

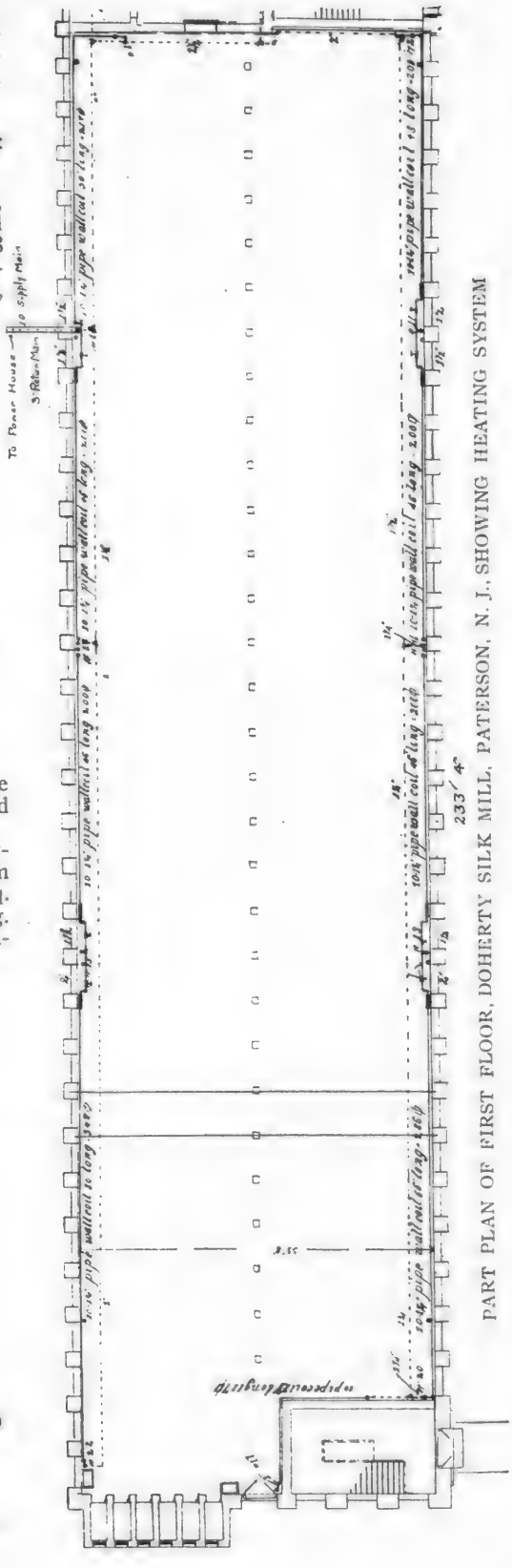
supplied with exhaust steam from the power house, situated directly behind the mill.

Steam at atmospheric pressure is circulated by means of a 6x8x12 in. vacuum pump, operating on a total of 19,000 sq. ft. of radiation in the entire building. Each coil is equipped with a Mowell au-

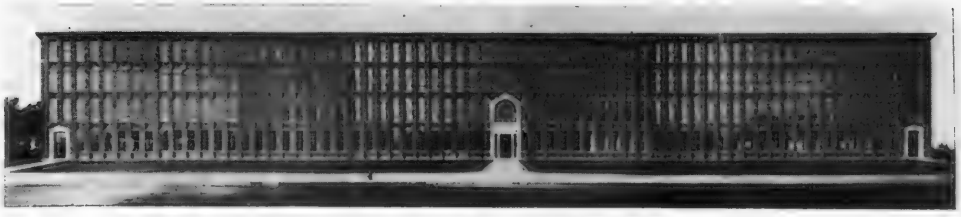




METHOD OF DRIPPING OVERHEAD COILS, DOHERTY SILK MILL



PART PLAN OF FIRST FLOOR, DOHERTY SILK MILL, PATERSON, N. J., SHOWING HEATING SYSTEM



DOHERTY SILK MILL, PATERSON, N. J.

tomatic relief valve, 86 of these valves being included in the installation.

The general layout of the system may be noted from the accompanying typical part floor plan. The main riser is run to the fourth floor ceilng and thence to the branch risers, the system being down feed. A notable feature of the layout is the small sizes of the return risers made possible by the use of the Mowell type of valve.

The system was designed and installed by Augustus Mowell, Paterson, N. J., and has been in operation one winter during which time it has operated with unusual success

Improved Expansion Joint

A new type of packingless, diaphragm expansion joint has recently been placed on the market by the Central Station Steam Co., of Detroit, Mich. The accompanying interior view of a double joint shows the construction and method of operation.

The double joint consists of two annular diaphragms of heavy cold-rolled and annealed copper, clamped at their outer edges between a cast iron "inner-ring" and two cast iron "outer-rings" and having their inner edges spun through and around the inner edges of the cast iron "backing-rings." The copper is brought far enough up on the outside face of the backing-ring to permit

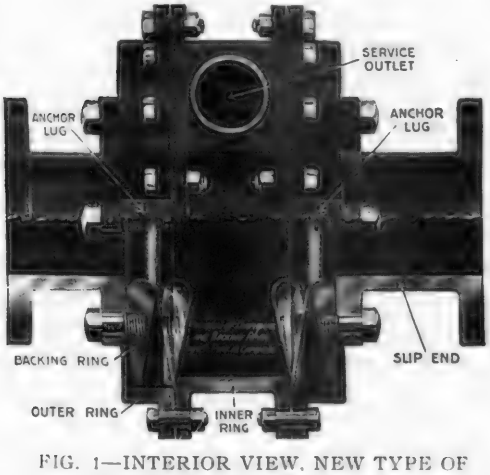


FIG. 1—INTERIOR VIEW, NEW TYPE OF DOUBLE EXPANSION JOINT

of clamping it securely between the backing-ring and the "slip-end" which is a short, flanged cast iron nipple. The outer-ring, inside of which and concentric with which the backing-ring is located, is recessed to a depth considerably in excess of the thickness of the backing-ring.

In operation, the joint is placed in the pipe-line with the slip-ends and backing-rings drawn out to their farthest limit. The inner-ring and outer-rings are rig-

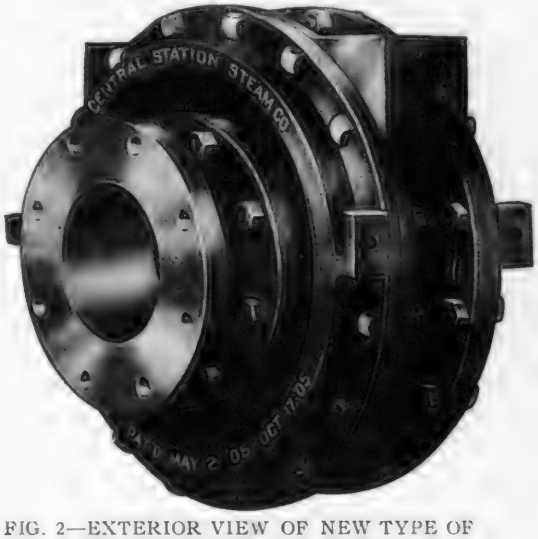


FIG. 2—EXTERIOR VIEW OF NEW TYPE OF DOUBLE EXPANSION JOINT

idly anchored, by cast-iron lugs, into the concrete or brick box built around the joint, and service-pipes to the buildings on each side of the street are connected to the service-outlets. As the pipe expands, the slip-ends and backing-rings move toward the middle of the joint and the copper diaphragm, which touches the backing-ring only at the inner edge when the pipe is contracted, is now drawn close over the backing-ring which reinforces it and carries the pressure of the steam.

But few parts enter into the construction of this device, a double joint capable of taking up the expansion in 100 ft. of line having only nine parts, exclusive of bolts and anchors. The diameter is also small, resulting in a saving in cost of the masonry work around the joint. The diaphragms are smooth, without

FIG. 3—SINGLE EXPANSION JOINT

corrugations to crystallize and break in service, and changes of position due to expansion bring no tensile strains on the copper. The maximum bending of the copper at any point, due to change of position, cannot exceed 10°.

A large factor of safety has been provided in the length of traverse. The general practice is to provide for ⅞-in. expansion in 50 ft. of line. These joints are designed to permit of 1¼-in. in 50 ft.

The single joint is similar in construction to the double joint except that it has but one diaphragm and is designed to take up the expansion in only 50 ft. of line. The construction is patented.

The Value of Ventilation is discussed in a new circular issued by the Hackney Ventilating Company, St. Paul, Minn., which also contains a description, with photographic illustrations, of the Hackney system of ventilation. This system is based on the principle that ventilation consists in introducing air into a building from out-of-doors, circulating it thoroughly, but without drafts, and finally discharging it again from the building. In order to accomplish this result two blowers are used, one to force the air in and another to draw it out. These two blowers are each designed to handle the same quantity of air. The general arrangement of the system may be noted by referring to the accompanying illustration. The company also manufactures a smaller portable type to be set in the window, simultaneously supplying fresh air and exhausting vitiated air.

HACKNEY VENTILATING UNIT AS USED IN SCHILEK'S CAFE, MINNEAPOLIS

TRADE AND MISCELLANEOUS NOTES

Coming Events

May 29-June 1, 1911. Twenty-third annual convention of the National Association of Master Steam and Hot Water Fitters, at Chicago, Ill. Headquarters at the Hotel Sherman.

May 30-June 2, 1911. Spring meeting of The American Society of Mechanical Engineers at Pittsburg, Pa.

June 6-8, 1911. Third annual convention of the National District Heating Association at Pittsburg, Pa. Headquarters will be at the Fort Pitt Hotel.

June 13-15, 1911. Annual convention of the National Association of Master Plumbers, Galveston, Texas. Headquarters at the Tremont Hotel.

Deaths

James R. Wade, manager of the St. Louis branch of the Consolidated Engineering Co., of Chicago, and late president of the National Vacuum Steam Heating Co., of St. Louis, shot himself in his office in that city, March 10. He died instantly. He was 57 years old. Mr. Wade was a member of The American Society of Heating and Ventilating Engineers. He leaves a widow.

Frederick S. Gillis, a retired member of the firm of Gillis & Geohegan, New York, one of the oldest contracting firms in steam and hot water heating in the country, was killed through the accidental discharge of a revolver which he was in the act of cleaning in his apartments in New York, March 20. He was a son of the late Charles A. Gillis and his interest in the firm of Gillis & Geoghegan was recently purchased by the sons of Stephen J. Geoghegan. He is survived by his wife.

Miscellaneous Notes

Ingenieria, the Spanish trade journal

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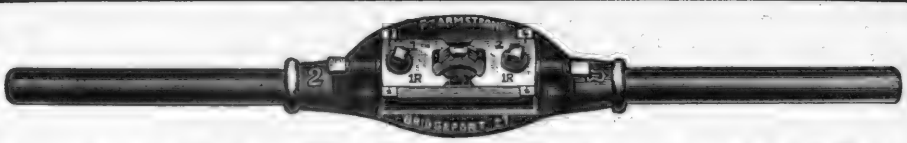

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formerly published by John A. Allen and Elmer T. Crawford, for many years publishers of *Domestic Engineering*, Chicago, has been purchased by The America Co., 1 Madison ave., New York, and will hereafter be published in New York instead of Chicago.

Lewis & Kitchen, Chicago and Kansas City, the well-known heating and ventilating engineers and contractors, announce the addition to their partnership of Samuel R. Lewis, who has been identified with the business for the past fourteen years as consulting engineer. The firm has heretofore been composed of Edward C. Lewis, father of Samuel R. Lewis, and John H. Kitchen, partners. The business will be conducted under the same name with offices in Chicago and Kansas City and factory in Kansas City.

Harry S. Martin has resigned as sales manager of the Hart & Crouse Co., Utica, N. Y.

Plumbing, Steam and Metal Salesmen's Association of Maine held its fifth annual meeting and dinner, at the Riverton Park Casino, Portland, Me., March 13. The following officers were elected: President, Stewart Mallard, Henick Co., Boston; first vice-president, George W. Paul, Crane Co., Boston; second vice-president, Byron E. Near, H. W. Johns-Manville Co., Boston; third vice-president, Archibald E. Campbell, Wm. H. Gallison Co., Boston; secretary-treasurer, W. F. Snow, J. L. Mott Iron Works, Boston.

E. N. Hannaford, mechanical engineer for the Cincinnati Board of Education, has resigned to become associated with Peck, Anderson & Peck, Cincinnati, heating and ventilating engineers and contractors.

Charles F. Hauss, sales manager of the Societa Nazionale dei Radiatori, Milan, Italy, the representatives in Italy of the American Radiator Co., has paid a brief visit to the home office in Chicago, returning by the Lusitania March 22.

Richard D. Kimball Co., New York, announces the resignation of S. H. Brooks as manager of its Department of Inspection and Tests. Mr. Brooks has been appointed sales manager for the Monarch Vacuum Cleaner Co., in Indiana, Ohio, and other States, with headquarters in Indianapolis.

R. P. Bolton Co., Liberty Tower, Nassau and Liberty Sts., New York, is the title of a new firm that will engage in "construction engineering." The firm is composed of Reginald Pelham Bolton, president of The American Society of Heating and Ventilating En-

Where Is There a Heating and Ventilating Engineer

who wishes to find a ventilator which will produce a positive draught no matter from which direction the wind blows, which will prevent a down draught and at the same time exhaust twice as much air per hour as any other gravity ventilator?
If he will write to us we will send him a booklet describing the "Vacuum" which will do all of these things and more too.

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Continuous Jointless Pipe Covering
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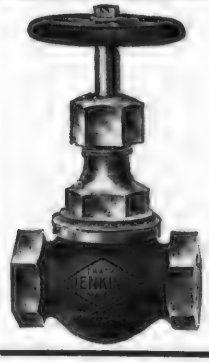
gineers; Frederick A. Forgee, and M. F. Thomas, members of the same society. All three members of the firm are well known to the trade, having long been engaged in mechanical engineering work.

United Bunch of Sheep, Supreme Fold, which is the title of the national organization of this body of salesmen, held its annual meeting in Chicago, March 18. The attendance included sixteen duly elected representatives from the various branch folds and nearly forty additional members. The following officers were elected: Supreme grand ram, T. H. Hutchinson, New York; supreme vice-ram, E. C. Molby, New York; supreme keeper of golden fleece, Henry Stein, New York; supreme shearer, J. W. Gannon, New York; supreme shepherd, F. H. Meadows, Milwaukee; supreme herder, Walter S. Rait, Chicago; supreme bell sheep, A. P. Dease, Chicago; past-grand ram, J. T. Ketchum, Milwaukee.

Baltimore, Md.—The sale of the property and franchises of the Baltimore Refrigerating and Heating Co., which was made on February 1 to the Central Securities Co., at the price of $503,000, has been formally ratified by Judge Stockbridge in Circuit Court No. 2.

Manufacturers' Light & Heat Co., Chicago, announces the election as its president of John E. Gill, of Franklin, succeeding Edward H. Jennings. James I. Buchanan has been elected second vice-president, a newly-created office.

Madison, Wis.—Judge Stevens of the circuit court has decided that the trustees of the Cawker estate in Milwaukee are not under the control of the railroad commission. The plaintiffs own and operate a heating plant in connection with the Cawker building in Milwaukee which furnishes heat, light and power to the building. The plant was installed and maintained by the plaintiffs to meet their own demands, and finding that it created more heat and light than was necessary for their own use they entered into an agreement with three tenants to furnish them with what they would need. The railroad commission held that the Cawker plant is a public utility. The court says: "There is nothing in the legislative intent as expressed in the law or in the facts pleaded with relation to plaintiff's plant that would warrant the court in holding that the three persons or corporations to whom light, heat and power are furnished by the plaintiff constitute the public, within the meaning of the statutes."



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ADDRESS

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Pittsburg, Kan.—A committee of the local board of education, appointed to inquire into the various systems of heating in Kansas City and Topeka, has made a report of its findings in which it states that after seeing plants in operation both in school houses that have been built six or eight years and in new buildings in both cities, it recommends the furnace blast system, with automatic regulation, for the heating of school houses, which was the predominant type found by the committee in both Topeka and Kansas City.

Eastern Illinois Heating League is an organization formed March 28 last at Champaign, Ill., composed of heating contractors and engineers from nine cities and towns of Eastern Illinois. The league is organized to promote both the commercial and technical features of the business as well as to take up the matter of the relations of employers and employees. The following officers were elected: President, E. J. Ryan, Danville; vice-president, Dick Johnson, Champaign; secretary-treasurer, Fred White, of White & Hanson, Mattoon. The charter members of the new organization are: O. W. Sebring, Cissna Park; A. W. Murray, Hoopeston; L. W. Straw, Carson & Co., Carson-Payson Co., W. S. Hannum, King Bros., E. A. Mahoney, M. E. Meeker, E. J. Ryan, Uhlein & Burrow, all of Danville; Webster & Holmes, Urbana; Johnson Bros., Reliable Plumbing & Heating Co., E. A. Robinson, W. R. Wozencraft, R. E. Young, Carson-Payson, all of Champaign; Henry L. Williams, Farmer City; White Plumbing & Heating Co., Charleston; White & Hanson, Mattoon, and Gill R. Capen, Mattoon.

Manufacturers' Notes

Crane Co., Chicago, has begun the erection of a branch supply house at Ogden, Utah.

McNab & Harlin Mfg. Co., 56 John St., New York, manufacturers and dealers in heating and plumbing supplies, will move to larger quarters directly opposite its present location, which it has occupied for upwards of twenty-five years.

John T. Young Boiler Co., Norwich, Conn., will double the capacity of its plant by building a machine shop 100x50 feet. A new 30x30 ft. office building will also be constructed.

Niagara Radiator & Boiler Works, North Tonawanda, N. Y., is adding eight new buildings to its plant at a cost of $100,000, which will double its present capacity. E. C. Andrews is president and general manager.

Shirley Radiator & Foundry Co., Shirley, Ind., announces the appointment as general manager of the company of Charles E. Gates, for many years general manager of the plant of the McElwaine-Richards Co., at Noblesville, Ind. The plant is being greatly enlarged by the receivers, the Union Trust Co., of Indianapolis. Late additions to the company's line are a standard 3-col.

FOR PIPE JOINTS

You can't do better than use Dixon's Pipe-Joint Compound on all pipe joints—keeps all joiets tight.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J.

McDaniel Improved Steam Trap

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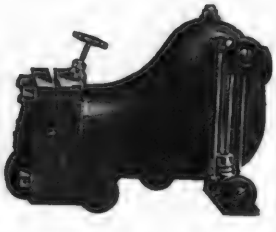

When you need a Steam Trap buy one you know will work. With a McDANIEL we take all the chances. Don't pay until you are satisfied. We have been 25 years manufacturing Steam Traps and know there is no better trap made. May we send you one for trial?

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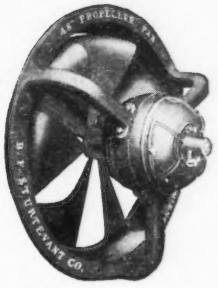

The design of our Propeller Fans is along the same scientific lines as all our fan product, and that is why Sturtevant Propeller Fans deliver more air for the same size fan and with less power expenditure than any other propeller type made. The construction is particularly strong and durable.

They will quickly change the air in factories, workrooms, kitchens, billiard halls, etc., carrying away the smoke, fumes, and hot air, keeping the atmosphere sweet and cool.

The electric fans are equipped with motors wound for either alternating or direct current. They may be installed in any position and controlled from any point desired.

Ask for Bulletin No. 146 V

B. F. STURTEVANT CO.

HYDE PARK, MASS. 809

38-in. 5-ft. radiator, both plain and ornamental, and an 18-in. round boiler for both water and steam.

Novelty Iron Co., Canton, O., manufacturers of heating boilers, announces the following changes in its officers, which has led to the report that the company has been purchased by Eastern capitalists at a sum stated to be in the neighborhood of $300,000. The new officers are: President, Huntlie Gordon, Boston; vice-president and general sales manager, George E. Downe; secretary and treasurer, H. H. Bryan, Johnstown, Pa., succeeding W. E. Sherlock. It is stated that the changes will not affect the operation of the plant.

Reading Stove Works, Orr, Painter & Co., Reading, Pa., announces that it will discontinue the manufacture of its line of steam and hot water heating apparatus, although repairs for these goods will be kept in stock.

Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., has opened a new branch in Cleveland, consisting of office, showrooms and warehouse. J. H. Bacon, Jr., is in charge.

New Work

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until May 9, 1911, for the construction complete, including plumbing gas piping, heating apparatus, electric conduits and wiring of the U. S. Post Office at Faribault, Minn.

Minneapolis, Minn.—The city hall and courthouse will be equipped with a new ventilating system by the adoption of tentative plans by the city and county building commission. The action followed the reading of the recent grand jury report which sharply criticised the management of the building in recent years. Chief Engineer George Hull declared that the cold air ducts are twice too large and that the principal portion of the system had been shut off because of the dirt it carried into the rooms.

Oklahoma City.—Among the bills passed in the final hours of the legislature March 12, was one appropriating $16,400 for a heating plant at the Claremore preparatory school.

Fort Wayne, Ind.—Owners of the fifty-six lots bordering on Forest park boulevard in the new Forest park addition have taken up the problem of installing a central hot-water heating plant to heat all the homes on the boulevard.

Business Changes

National Plumbing & Heating Supply Co., Chicago, has increased its capital stock from $25,000 to $75,000.

New Incorporations

Quadruple Steam Pump Co., Jersey City, capital $25,000, to engage as tool makers, metal workers, boiler makers, etc. Incorporators: Arthur McNeil, John W. Derbyshire and Frank E. Collier.

E. Best Plumbing & Heating Co., Quincy, Ill., capital $30,000, to engage in heating, plumbing, electrical and gas fitting contracting business. Incorporators: Ezra Best, Seward Best and T. Russell Bunting.

Slater Weather Strip Co., Buffalo, N. Y., to manufacture metal weather strip. Incorporators: J. J. Slater, H. I. Slater and D. J. Ward, all of Buffalo.

Smith Bros. Plumbing Co., Inwood, N. Y., capital $50,000. Incorporators: Charles Smith, J. Ezra Smith and George W. Foren.

Bishop-Babcock-Becker Co., Cleveland, O., is the new title of the Bishop & Babcock Co., manufacturers of vacuum heating appliances, also soda water fountains and beer pumps, as the result of the absorption of the Becker Company, of Chicago. The company's capital stock has been increased from $4,500,000 to $8,500,000. The new officers are: President, K. D. Bishop, who was president of the Bishop & Babcock Co.; vice-president, L. A. Becker, formerly president of the Becker Co. In addition to building additions to its plants in Cleveland and Indianapolis, the company will erect a new plant at Dallas, Texas.

Canton Heating & Foundry Co., Canton, Ill., has been organized to succeed the Savill-Chandler Co., of that place and will manufacture heating boilers, radiators and valves and do general foundry work.

Evansville Plumbing Co., Evansville, Ind., capital $10,000, to conduct a general heating and plumbing business. Incorporators: Emil H. Hartig, Anna Hartig and C. F. Werner.

Selman Heating & Plumbing Co., Birmingham, Ala., capital $15,000, to conduct a heating, ventilating and plumbing business.

Ellis Radiator Co., San Francisco, Cal., capital $50,000. Incorporators: M. S. C. Ellis, J. W. Stearns, W. J. Clarke, E. H. Hechman, W. A. Moffett, T. F. Draper and E. Marmet.

D. and T. Mfg. Co., St. Louis, Mo., to manufacture and deal in heating apparatus. Capital, $30,000, three-fourths paid. Among the stockholders are John M. Dougherty, Harry C. Tabler, George E. Miller, James W. Gill, John P. Assmann, Joseph Barrett, Henry Heimberg and Edward J. McMullen.

Koblitz Plumbing & Heating Co., Cleveland, O., capital $25,000. Incorporators: O. E. Koblitz, D. N. Tilden, and N. J. Young.

Contracts Awarded

H. T. Wheelock, Burlington, Vt., heating, ventilating and plumbing new Lamoille County courthouse, jail and sheriff's residence for $3,091.

Wanner Steam and Hot Water Heating Co., Baltimore, Md., water pipe and steam heating for sewerage station in that city. The contract amounts to $3,100.

H. Kelley & Co., Minneapolis, Minn., heating and ventilating the new high

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Air Washers and Humidifiers
Made of Galvanized Iron, Copper or Concrete.
We use WATER FILM CLEANING SURFACES with the spray from our flushing spray heads.
Hence the superior efficiency of our distinctive design.
Your name through the mail will bring our literature
McCREERY ENGINEERING CO., Detroit, Mich.

school building at Albert Lea, Minn., for $18,500. The plumbing contract went to the Fort Dodge Heating and Plumbing Co., Fort Dodge, Ia., for $7,421.26.

Lane & McNally, Hannibal, Mo., heating Souch school annex at that place for $2,777.18.

Allen, Myers & Co., Rock Island, Ill., heating new Rock Island Savings Bank building in that city.

American Heating Co., Duluth, Minn., heating system for remodeled Metropolitan building in Duluth.

Healy Plumbing and Heating Co., St. Paul, Minn., heating and plumbing for the laundry building at the city hospital for $6,195.

Buffalo Forge Co., Buffalo,, N. Y., contract for ventilating systems in the Anchor Line boats "Juniata" and "Octorara," for the Erie and Western Transportation Company of Buffalo. The company had already installed similar system in the steamer "Tionesta" of the same line. This system was for the inside staterooms. Its successful operation led to the subsequent order. The Buffalo Forge Company also reports an order received from the New Jersey Zinc Company for 54 large special fans. It is estimated the fans will make up over eight carloads. The order, the company states, was placed after a number of different manufacturers had been given an opportunity to install an experimental blower to be tested for efficiency under special but identical conditions. The contract was awarded to the Buffalo fan in accordance with the showing made.

Evans Plumbing Company, Niles, Mich., heating, ventilating and plumbing new central school building, in that place, for $20,000. Garden City Fan Company's apparatus will be used. The latter company's plant is located at that point.

Modern Science Club, Brooklyn, N. Y., was addressed March 14 by James A. Donnelly, on "Standard Devices for Exhaust Steam Heating," illustrated by stereopticon.

Brooklyn Engineers' Club, Brooklyn, N. Y., held a "ventilation meeting" March 9, when W. W. Macon read a paper on "Late Ideas on Ventilation," in which he discussed the new theories on this subject which have recently been advanced.

Trade Literature

Tachometers and Tachographs, stroke and revolution counters, of Dr. Th. Horn, Leipzig, Germany, are made the subject of a special bulletin (No. 40), by the Industrial Instrument Co., Foxboro, Mass, exclusive agent for the United

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is a specially-made tile conduit, salt glazed inside and out, and is absolutely water-proof. It never deteriorates like wood and brick conduits. Acids, gases or the chemical action of the earth do not affect this conduit. Neither can the weight or movement of pipes injure it. This conduit will easily carry steam at least 1000 feet without practically any condensation. It saves 90 per cent. of the heat lost in transmission through unprotected or poorly insulated pipes. When laid only 6 inches underground, snow directly over it will not melt.

Divided in upper and lower sections, the lower of which is laid first, all piping may be laid and inspected under pressure before the upper half is cemented on. When the upper half is cemented on, the conduit is hermetically sealed. Yet it can be easily opened at any time to locate leaks in pipes. It can even be taken up and relaid without injury. J-M Sectional Conduit is equally efficient for conveying gas, water, brine or other liquids underground.

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(1266)

An Unusual Opportunity for Manufacturers of Safety Appliances

To assist the manufacturers, merchants and employers generally of Illinois toward prompt compliance with state laws regarding "health, safety and comfort of employees", the Chief Factory Inspector, Edgar T. Davies, is compiling a list of makers of all appliances used for such purposes.

Manufacturers of Safety Appliances, Clutches and Power Transmission on safety controlling devices, Belt Shifters, Stamping Press Guards, Wood Working Machinery Guards, Elevator Hatchway Guards and Gates, Elevator Locks for Shipper Rope, Laundry Machinery Guards, Hydro-extractor Guards, Ventilation and Sanitation Apparatus, Disinfectants, Guards for all Moving Parts, Set Screws, Rubber Mats, Stair Treads and other safety equipments

should send in their names, addresses and list of their appliances. This information will be published without discrimination of display or position, and with absolutely no expense to any manufacturer represented. The expense is borne by the state.

Send information to-day to Edgar T. Davies, Chief Factory Inspector.

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States. All speed measuring instruments are listed from simple speed indicator to counter revolution to the elaborate precision variation recorder. The catalogue is fully illustrated. Pp. 36. Size 8x11 in.

Bruce-Macbeth Vertical Multi-Cylinder Gas Engines, for electric lighting, pumping and all general power purposes, using either artificial, natural or producer gas, or gasoline, are described in a newly-issued catalogue devoted to the product of the Bruce-Macbeth Engine Co., Cleveland, O. The various features of this type of engine are covered in detail, with exterior and interior views of different parts of the mechanism, accompanied with view of typical installations. Pp. 32. Size 7x10 in.

Some of the Factors that Affect the Cost of Generating and Distributing Steam for Heating, a paper by Charles R. Bishop, read at the last annual convention of the National District Heating Engineers in Toledo, has been reprinted by the American District Steam Co., North Tonawanda, N. Y., as Bulletin No. 120. We understand that copies may be had for the asking by addressing the company.

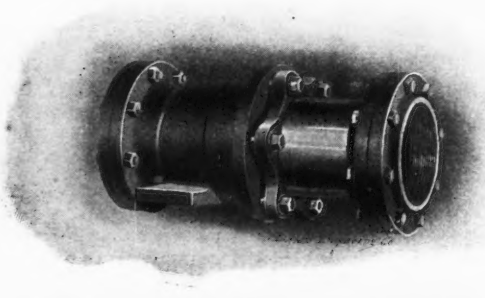
Ventilation in Its Relation to Health, a paper read by William G. Snow at Cornell Unversity in the course on "Sanitary Science and Public Health," in cooperation with the New York State Department of Health, and published in part in THE HEATING AND VENTILATING MAGAZINE for August and September, 1910, has been printed in full by Warren Webster & Co., Camden, N. J., from whom copies may be obtained without charge.

Bicalky Roof Fan Ventilator is the subject of a new booklet, published by the Bicalky Fan Co., Buffalo, N. Y., showing a number of typical installations of this ventilator taken from photographs. These include roof views of the Hotel Statler in Buffalo, which is equipped with Bicalky devices; also interior views of a smelting plant before and after the Bicalky ventilators were installed. The company announces that the other specialties it manufactures include Bicalky dust arresters and Bicalky air washing and humidifying apparatus.

Steam Specialties manufactured by W. A. Russell & Co., 63 West 37th street, New York, are described in a newly-issued catalogue, covering the company's line of automatic air valves, positive key and wood wheel air valves, floor and ceiling plates. The Russell air valves have been manufactured by this company for 20 years and these devices, together with its line of floor and ceiling plates, enjoy a wide and deserved reputation. Pp. 69. Size 3½x6 in. (standard).

Armak Steam Vacuum Heating System is the subject of Bulletin No. 2, published by Arthur McGonagle, 136 Liberty street, New York. Special attention is called to the fact that in offering this system for sale, no charge is made for royalty. While doing no erecting the company states that it will be glad to furnish plans for complete installations. In addition to a full description of the system, and of the devices used in connection therewith, the bulletin shows typical layouts properly designed for operation with the Armak devices. Pp. 14. Size 6x9 in. (standard).

What Boiler Ratings Mean to You, published by the Richardson & Boynton Co., New York, presents a comparison of Richardson boiler ratings as they are and as they would be at higher rates of combustion. The tables presented show the original and present ratings and list prices of Richardson boilers, together with the ratings as they would be burning coal at 5½, 6, 7 and 8 lbs. per square foot of grate per hour. The company states that these tables make possible a comprehensve comparison of the ratings and prices of Richardson boilers with those of any other manufacturer. Examples are included showing how to make use of the tables. Pp. 16. Size 5x7½ in.



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